

According to new NCISM Syllabus

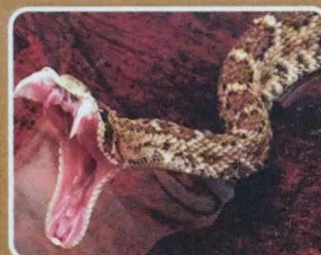
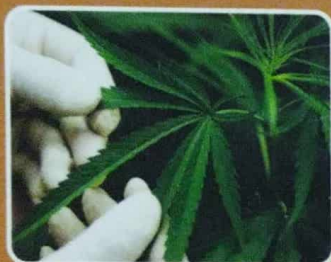


Illustrated Textbook of **AGADA TANTRA EVAM VIDHI VAIDYAKA**



FIRST EDITION

TOXICOLOGY, FORENSIC MEDICINE & MEDICAL JURISPRUDENCE



Salient Features:—

- Aligned with the new NCISM syllabus, this textbook offers students a comprehensive and in-depth understanding of Ayurveda, as well as modern perspectives on Toxicology, Forensic Medicine, and Medical Jurisprudence
- Includes contemporary relevance, research updates and clinical significance, to bridges the gap between traditional wisdom and modern scientific advancements.
- Well-organized tables and self-explanatory diagrams with high-quality colored illustrations to enhance comprehension and visual learning
- Various classical reference is provided as and when needed to support key points, offering students a good framework for further study and application.
- Each chapter is summarized to provide a quick overview of key concepts. Also includes multiple choice questions (MCQs) and important questions at the end of each chapter.
- Covers latest legal updates and legal sections for broader understanding of the subject with extra points that highlight critical aspects of Agadatantra.
- The contents are presented in an easy to understand, making complex concepts acceptable for students.



DR. JYOTHI SAJAYAN

Foreword by Prof. Ashwin Kumar S. Bharati

As per the competency-based Ayurveda Medical Curriculum

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AGADA TANTRA
EVAM
VIDHI VAIDYAKA
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& MEDICAL JURISPRUDENCE**

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According to New NCISM Syllabus

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Concept of Agadatantra (Clinical Toxicology)

1.1 Agada Tantra and Clinical Toxicology

Agada Tantra

Definition

अगदतन्त्रं नाम सर्प कीट लूत मूषिकादि
दष्टविष व्यञ्जनार्थं विविध विष संयोगोपशमनार्थं च।

[Su. Su. 1/8 (6)]

- ❖ Agada is medicine against poison or toxin
- ❖ Tantra is the science
- ❖ Agadatantra is the science dealing with all aspects of poison or toxin.

Agadatantra, one among eight branches of ayurveda, is intended for diagnosis and management of various poisoning such as bites of sarpa (snake), keeta (insects), lootha (spider), mushaka (rats), etc.

Agadatantra in various Text books

- ❖ विषगर वैरोधिक प्रशमन – Acharya Charaka
- ❖ दंष्ट्रा चिकित्सा – Ashtanga Hridaya/Ashtanga Sangraha
- ❖ जाङ्गुलिक – Amarakosha
- ❖ अगदतन्त्र – Sushruta

विष चिकित्सा/विष विज्ञान/विषतन्त्र – Commonly used Names

References of Agada Tantra in Various Samhitas

1. Ch.Chi. 23rd chapter – Vishachikitsa
2. Su. Kal. – 8 chapters complete

3. A.Sang. Uttara Sthana – (40 -48) Chapters

4. A. H.U. – (35- 38) chapters

Clinical Toxicology

Clinical Toxicology is specific pathophysiological changes caused by various toxic agents and its management. It mainly focusses on the study of interaction between these toxic agents and humans.

Clinical toxicology plays very important role in acute poisoning, which may be either intentional, accidental or occupational.

Principles of diagnosis of poisoning include clinical history, physical examination and analytical evidence. And this is followed by general principles of management of poisoning including neutralisation of poison and removal of poison.

Factors causing poisoning effects

There are various factors that cause the poisoning effects in the Body–

- ❖ **Composition of toxic agent:** Knowing the physiochemical composition of the toxic agent gives an idea about the signs and symptoms. In general, solids are less easily swallowed than the liquids.
- ❖ **Particle size of a compound:** It is important especially in the case of exposure of toxic

substance by inhalation. Only particles with less diameter can reach the lung alveoli.

- ❖ **PH of a substance:** It is another factor to be considered. If the chemical is corrosive, for instance strong acids and alkalies, it may cause strong burns it.
- ❖ **Dose and concentration of substance:** Nearly any substance can act as toxic at a given dose and route of administration. Even the most toxic one can be harmless in extremely low concentration.
- ❖ **The Route of administration:** The manner in which the potentially toxic compounds may enter the body can affect the time of onset, severity and duration of clinical symptoms. Route of administration may also predict the degree of toxicity and possible target system which is mostly affected by the toxin.
- ❖ **Metabolism of toxic agent:** Most of the toxins are eliminated through the metabolism. Through metabolism, metabolite is formed which is more polar compound, that can easily be excreted from the kidneys. However, this is not always the same. Some chemicals are activated to compounds or the metabolite which are more toxic than the original compound.

Example: In methanol poisoning, the by-product formed is formaldehyde which is more toxic than methanol.

Death of Patient occurred in Poisoning

The reasons behind the death of a patient in poisoning are:

- ❖ Depress the CNS
- ❖ Cardio vascular toxicity
- ❖ Cellular hypoxia
- ❖ Seizures, muscular hyperactivity
- ❖ Other organ damages

Assesement

- ❖ Clinical assessment
- ❖ Lab investigations
- ❖ Liver function test
- ❖ Renal function test
- ❖ ECG
- ❖ D-imaging techniques (x-ray, CT scan, USG, MRI...)
- ❖ Toxicology screening test

Initial management of Patient in Poisoning

"ABCD" approach

- A. Airway:** It should be cleared of vomitus or any other obstructions and oral airway or endotracheal tube should be inserted if needed.
- B. Breathing:** It is assessed by observation oximetry and arterial blood gases.
- C. Circulation:** Monitoring of pulse rate, BP, urinary output, evaluation of peripheral perfusion.
- D. Dextrose:** Alcoholic or malnourished patients should receive 100mg of thiamine IM or in IV infusion solution to prevent Wernicke syndrome.

Basic outcomes of Poison management

- ❖ **Reduce absorption of poison**
 - Removal from the surface of skin and eye (wash with soap and water)
 - Emesis induction
 - Gastric lavage
 - Activated charcoal administration
 - Dilution-milk/other drinks for corrosives
 - Endoscopic or surgical removal of toxins
- ❖ **Enhances elimination**
 - Keep a good urine output of 150-200ml/hr
 - **Alkalinisation** of urine for poisons such as salicylates and phenobarbital

toxicity achieved by IV administration of bicarbonates.

- Haemodialysis

❖ **Neutralise toxin - by using specific antidotes**

1.2 Scope of Agadatantra

1. Protection of healthy individuals from poisoning.
2. Management of individuals affected with poison.

In current scenario, maximum diseases are caused due to idiosyncratic etiology or xenobiotics or due to cumulative toxicity. *Agada Tantra* is one of the eight branches of Ayurveda which focusses on various types of toxicities due to bites, poisons, which also includes *Viruddhaahara* (Incompatible food), *Gara Visha* (Concocted poison) and *Dushivisha* (Denatured/Latent Poison), different clinical conditions and their treatments. Many types of poisoning, environmental toxicity, Cancer, skin diseases are some example. In today's era, we need complete *Nirvishikarana* (Detoxification) because many of the diseases are caused due to cumulative, concocted and incompatible dietary habits. So, *Agada Yogas* need to be evaluated and given in these conditions.

1.3 Definition of Visha and Poison, Synonyms, Visha Guna, Difference between Visha, Madya and Oja Guna, Visha Gati, Classification of Visha and Poison, Sthavara and Jangama Visha Adhishtana

Poison

Definition

Poison is defined as a substance (which is either solid, liquid or gas) which when administrated, ingested, swallowed is capable of acting deleteriously on the body. It is a substance causing illness or death, when eaten, drunk or absorbed even in

relatively small quantities. Thus, almost anything is a poison. Dose and duration of exposure is very important in determining the poisoning effect of any substance. All materials have the potential to be poisonous. Toxicology or the science of poisons is the study of adverse effects of chemical or physical agents on living organisms.

Visha

Definition

विषाद जननत्वाद् च विषं मित्यभिधीयते।

(Su. Ka. 3/21)

By the very first sight which causes **fear and grief** in the persons is called **Visha**.

जगत् विषण्णं तं दृष्ट्वा तेनासौ विषसंज्ञिताः।

(Ch.Chi. 23/5; A.H.U. 35/2)

देहं प्रविश्य यत् द्रव्यं दूषयित्वा रसादिकान्।

स्वस्थस्य प्राणहरं च स्यात् तत् द्रव्यं विषमुच्यते॥

(Ch. Chi. 23/1-2)

"That which enters the body causes **dhatu Pradooshana** (vitiation of dhatu) and causes the **death** of the organism immediately."

व्यवायि च विकाशि स्यात् सूक्ष्मं छेदि मदावहम्।

आग्नेयं जीवितहरं च योगवाहि तत् स्मृतं विषम्॥

(Sa. Sa. Pu. 4/22-23)

Eight qualities are mentioned for visha by Sarngadhara, they are:-

1. Vyavayi
2. Vikashi
3. Sookshma
4. Chedi
5. Madavaham
6. Agneyam
7. Jeevitaharam
8. Yogavaahi

Synonyms of Visha

विषं श्वेडश्च गरलं कालकूटश्च तन्मतम् -

(Rasatarangini-24)

- ❖ Kshveta

- ❖ Garala
- ❖ Kalakoota

Visha Guna

तीक्ष्णोष्ण रूक्ष विशदं व्यवायि आशुकरं लघु।

विकाषि सूक्ष्मं अव्यक्त रसं विषमपाकि च॥

(A. H. U. 35/7)

1. तीक्ष्ण – Potent, penetrating
2. उष्ण – Hot potency
3. रूक्ष – Dry
4. विशद – Viscid/unctious
5. व्यवायि – Spreads all over the body quickly
6. आशुकरं – Quick acting
7. लघु – Light
8. विकाषि – Causing looseness of joint, dilating the tissue pores
9. सूक्ष्मं – Capacity to enter minute pores
10. अव्यक्त रस – Imperceptible taste
11. अपाकि – Difficult to metabolise

Extra:

- ❖ **Vyavayi, Asukari and vikashi** are normally not present in all dravyas and normally not enlisted among Vimshati (20 gunas).
- ❖ **Vyavayi:** Spreads very fast in body.
- ❖ **Asukari:** It acts fast causing administration of treatment difficult in this condition.
- ❖ **Vikashi:** It destroys all other srotas, doshas and dushyas.
- ❖ **Laghu:** Anavasthitatwat durupakramam: It is difficult to cure.
- ❖ **Visadam:** Thin; It enters from one dhatu to another very easily through various srotas.

All Acharyas (Sushruta, Charaka) have mentioned Dasa Gunas (10 Gunas) for visha. Ashtanga Hridaya and Ashtanga Sangraha explain 11 visha gunas.

As Per Charaka Samhita

लघु रूक्षं आशु विशदं व्यवायि तीक्ष्णं विकाषि सूक्ष्मं च। उष्णमनिर्देश्य रसं दशगुणमुक्तं विषं तज्ज्ञैः॥

(C.Chi. 23/24)

1.	Laghu	Light
2.	Rooksha	Dry
3.	Asu	Quick acting
4.	Visada	Viscid
5.	Vyavayi	Spreads all over the body quickly
6.	Teekshnam	Potent
7.	Vikashi	Spreads all over the body quickly
8.	Sookshmam	Capacity to enter minute pores
9.	Ushnam	Hot potency
10.	Anirdesya rasam	Taste not clear

As per Sushruta Samhita

रूक्ष उष्ण तथा तीक्ष्णं सूक्ष्ममाशु व्यवायि च।

विकाशि विशदं चैव लघ्वपाकि च तत स्मृतम्।

(S.K. 2.20)

- ❖ Rooksha
- ❖ Ushna
- ❖ Theekshna
- ❖ Sookshma
- ❖ Asu
- ❖ Vyavayi
- ❖ Vikashi
- ❖ Visada
- ❖ Laghu
- ❖ Apaki

As Per Sharngadhara Samhita

व्यवायि च विकाशि स्यात् सूक्ष्मं छेदि मदावहम्।

आग्नेयं जीवितहरं च योगवाहि तत् स्मृतं विषम्॥

(Sa. Sa. Pu. 4/22-23)

1.	Vyavayi
2.	Vikashi
3.	Sookshmam
4.	Chedi
5.	Madavaham
6.	Agneyam
7.	Jeevitaharam
8.	Yogavaahi

Visha Madya and Ojus–Relationship**According to Acharya Charaka**विष गुण

लघु रूक्ष आशु विशदं व्यायि तीक्ष्णं विकासि
सूक्ष्मं च। उष्णं अनिर्देश्य रसं दशगुणमुक्तं विषं तज्जै ॥
(Ch. Chi. 23/24)

मद्य गुण

लघु उष्ण तीक्ष्ण सूक्ष्म अम्ल व्यायशुगमेव च।
रूक्षं विकासि विशदं मद्यं दशगुणमुक्तं स्मृतम् ॥
(Ch. Chi. 24/30)

ओजो गुणम्

गुरु शीतं मृदु श्लक्ष्णं बहलं मधुरं स्थिरम्।
प्रसन्नं पिच्छलं स्निग्धम् ओजो दशगुणं स्मृतम् ॥
(Ch. Chi. 24/31)

- ❖ The gunas of visha and madya are almost similar, but gunas of visha and ojus are opposite to each other.
- ❖ Visha and madya have 10 gunas each. Almost all the gunas are similar except RASA.
- ❖ For visha – rasa is **anirdesya rasa**
- ❖ For madya – rasa is **amla rasa**
- ❖ Visha and madya which have almost similar gunas are exactly opposite to the gunas of ojas.

Ashtanga Hridaya says Vagbhata

तीक्ष्णोष्ण रूक्षसूक्ष्मालं व्यायाशुकरं लघु विकासि
विशदं मद्यं ओजसो अस्मात् विपर्य तीक्ष्णादयो विषे
अप्युक्ता चित्तोपप्लविनो गुणा जीवितान्ताय जायन्ते
विषे तूत्कर्षवृत्तिः।

The qualities of madya like–

Teekshna, ushna, rooksha, sookshmam, amlam, vyavaayi, asukaram, laghu, vikasi, visadam are opposite to Ojus–

- ❖ Visha also has these teekshadi Gunas that aim to destroy Manas. Unlike Madya it is present in visha with its maximum potency or veerya, so that visha can cause instant death.

- ❖ The manda veerya visha or teekshna visha not properly eliminated can end up in Dooshi vish as time goes. Even madya also can lead to a dooshivisha avastha due to improper and continuous usage.
- ❖ Madya is amla in rasa whereas Visha is avyakta rasa.
- ❖ Madya is not **yogavaahi** and **apaaki**, whereas visha is **yogavaahi** and **apaaki**. (Even though Madya is absorbed as such in jatharagni paka but it get digested in dhatupaka).
- ❖ Madya has 2-4 vegas or avasthas whereas visha has 7 or 8 vegas.

Visha Gati

जङ्गमं स्यात् अधो भागं ऊर्ध्वभागं तु मूलजम्।
तस्मात् दंष्ट्रा विषं मौलं हन्ति मौलं तु दंष्ट्रजम् ॥

(C.Chi.23/17)

The jangama vishas have **adho gati** (downward movement) in the body whereas the sthavara vishas have **urdhva gati** (upwards direction). Therefore, the varieties neutralizes their action against each other.

Extra prativisha: विषे विषान्तर प्रयोग इति प्रतिविषः Works based on the principle of visha gati, that is *sthavara visha* is used in the treatment of *Jangama visha* and *Jangama visha* is used in the treatment of *sthavara visha*. This is also called **Visha prabhava**.

Example: *Karaveera arkadi yoga* in *sarpa chikitsa*.

Classification of Visha (विष वर्गीकरण)

विषं च उपविषं चेति द्विविधं स्थावरं विषम्।

प्रथमं वत्सनाभादि द्वितीयं तिन्दुकादिकम् ॥ (R.T.24/6)

- ❖ Visha and upavisha are the vishavargas.
- ❖ Visha includes drugs like *Vatsanabha* (*Aconitum ferox*).
- ❖ Upavisha includes *Vishatinduka* (*strychnus nuxvomica*) and others.

- ❖ Visha has 10 gunas while upavisha lacks some of the *dasagunas*.

Visha

हालाहलः कालकूटः शृङ्गिकश्च प्रदीपनः ।
सौराष्ट्रिको ब्रह्मपुत्रो हरिद्रः सक्तुकस्तथा ।
वत्सनाभ इति ज्ञेया विषभेदा अमि नवा ॥

(R.T.24/7-8)

According to Rasatarangini, visha are classified as nine in number.

They are:

- ❖ Halahala
- ❖ Kalakoota
- ❖ Shringika
- ❖ Pradeepana
- ❖ Sourashtrika
- ❖ Brahmaputra
- ❖ Haridra
- ❖ Saktuka
- ❖ Vatsanabha

Upavisha

अर्कक्षीरं स्नुहिक्षीरं लाङ्गलि करवीरकम् ।
गुञ्जाहिफेनश्च धत्तूरो वर्गो हि उपविषात्मकः ॥

(B.P.N.Dhatwadi varga)

लाङ्गलि विषमुष्टिश्च करवीरो जया तथा ।
नीलको कनकोर्को वर्गो हि उपविषात्मकः ॥ (R.R.S.10)

- ❖ Langali
- ❖ Vishamushti
- ❖ Karaveera
- ❖ Jaya
- ❖ Neelaka
- ❖ Kanaka
- ❖ Arka

विषतिन्दुकबीजं तु अहिफेनश्च रेचकम् ।
धत्तूरबीजं विजया गुञ्जा भल्लातकाह्वयम् ॥
अर्कक्षीरं स्नुहिक्षीरं लाङ्गलि करवीरका ।
समाख्यातो गुणोयं तु बुधैरुपविषात्मकः ॥ (R.R.S.24)

1.	Vishatinduka	<i>Strychnos nuxvomica</i>
2.	Ahiphena	<i>Papaver somniferum</i>
3.	Rechaka	<i>Croton tiglium</i>
4.	Dhatura	<i>Datura stramonium</i>
5.	Vijaya	<i>Cannabis indica</i>
6.	Gunja	<i>Abrus precartorius</i>
7.	Bhallataka	<i>Semicarpus anacardium</i>
8.	Arkaksheeram	<i>Calotropis gigantea</i>
9.	Snuhi	<i>Euphorbia nerifolium</i>

10.	Langali	<i>Gloriosa superba</i>
11.	Karaveera	<i>Nerium indicum</i>

Classification of Visha According To Various Acharyas

According To Charaka

Visha is of 2 types

1. Sthavara
2. Jangama

According To Sushruta

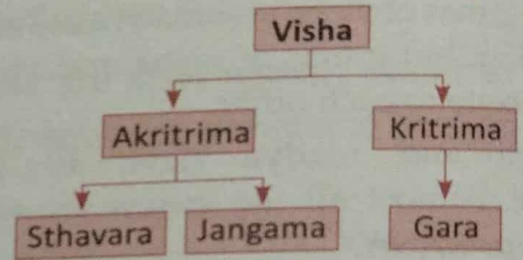
Visha is of three types

1. Sthavara
2. Jangama
3. Kritrima

According To Vagbhata

Visha is 2 types

1. Kritrima (artificial)
2. Akritrima (natural)



Classification of Poison

According to the mode of action poison is classified as 4–

- Corrosives
- Irritants
- Systemic
- Miscellaneous

A. Corrosives: is a chemical that causes visible destruction of or irreversible alteration in living tissue through chemical action at the site of contact. It causes inflammation and ulceration of living tissues.

Examples: strong acids and strong alkalies.

❖ Acids are of two types–

- **Organic acids:** Oxalic acid, acetic acid, formic acid and carbolic acid.
- **Inorganic acids:** Hydrochloric acid, sulfuric acid and nitric acid.

❖ **Alkalies are:** sodium hydroxide, potassium hydroxide, sodium and potassium bicarbonate.

B. Irritants: Irritant poison causes irritation of GIT, which produces abdominal pain, vomiting diarrhoea etc. They are of 2 types:

❖ **Inorganic Irritants:**

- **Non-metallic:** Phosphorus, sulphur
- **Metallic:** Arsenic, lead, mercury.

❖ **Organic irritants:**

- **Vegetable poison:** Calotropis, abrus precatorius, semicarpus, etc.
- **Animal poison:** Snakes, scorpion, wasp..

C. Systemic Poisons: Poison that affects a particular body system.

It includes:

❖ **Nervous:**

Cerebral

- **Somniferous:** Sleep inducing and pain relieving e.g.: opium derivatives
- **Inebriant:** Featured by excitement and narcosis, e.g.: alcohol, anaesthetics
- **Deliriant:** Induces brain and causes altered consciousness with confusion, delusion and hallucination, Dhatura.

Spinal: Acts on spinal cord e.g. Nux vomica (**spinal stimulant strychnine-Spinal Depressant:** Gelesmium).

Peripheral nerve affecting: Conium, Curare, Hemlock.

❖ **Cardiac:** Affects heart directly or through nerves e.g. digitalis, nicotine.

❖ **Respiratory:** Produces asphyxia, e.g. Carbon dioxide and carbon monoxide.

D. Miscellaneous: Includes

❖ **Analgesics:** Relieves pain without inducing sleep; e.g. acetaminophen.

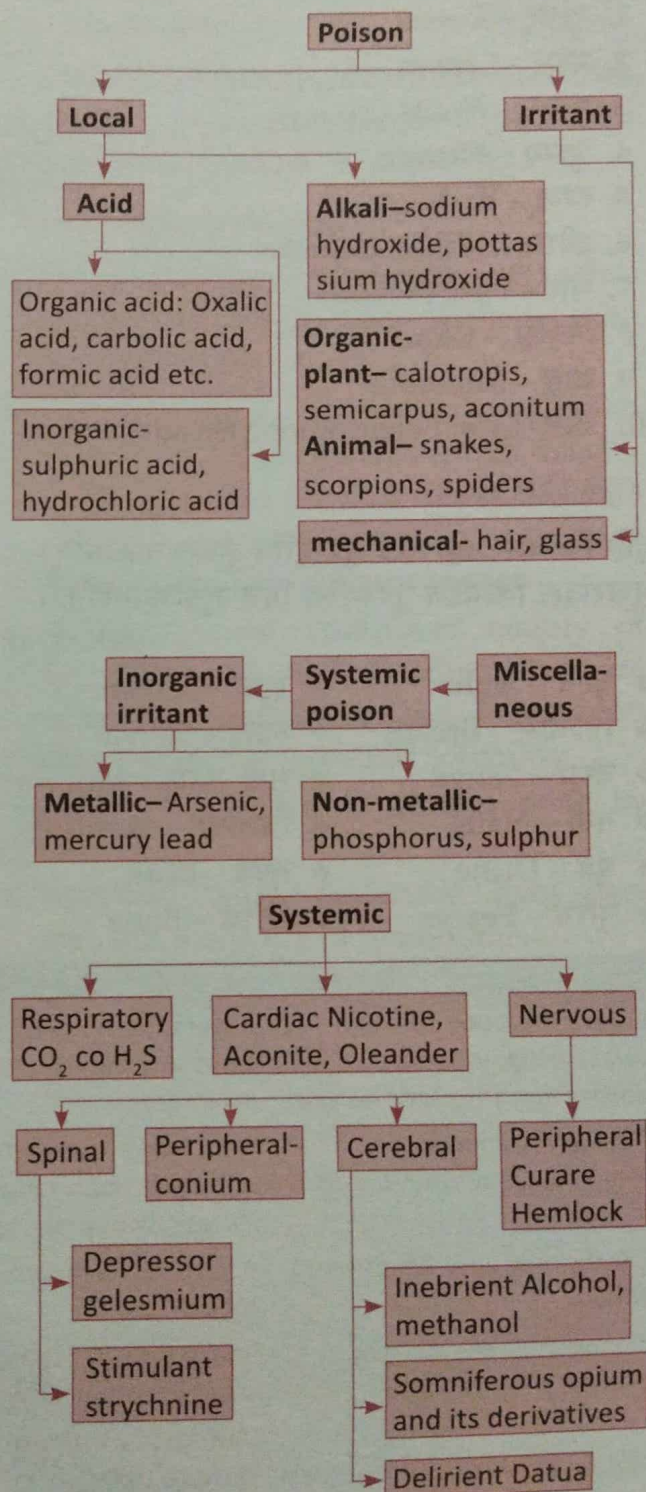
❖ **Antipyretics:** Lowers temperature: aspirin, paracetamol.

❖ **Anti-histamines:** Antagonize the action of histamine; e.g.: antihistamin.

❖ **Tranquillizers:** Relieves anxiety and mental tension e.g. riserpin.

❖ **Antidepressants:** Controls depression; e.g. imipramine.

❖ **Hallucinogens:** Produces bizzare effects on mind; e.g: LSD.



Adhishtanas of Visha

Sthavara visha adhishtana: 10 in number

Jangama visha adhishtana: 16 in number

स्थावर विष अधिष्ठान

मूलं पत्रं फलं पुष्पं त्वक् क्षीरं सार एव च ।

निर्यासो धातवश्चैव कन्दश्चैव दशमः स्मृतः ॥

1. मूलम् – Roots
2. पत्रम् – Leaves
3. फलम् – Fruits
4. पुष्पम् – Flower
5. त्वक् – Bark
6. क्षीरम् – Milky Exudate
7. सार – Heart wood
8. निर्यास – Resin
9. धातु – Minerals
10. कन्द – Most potent among ten adhishtanas.

जङ्गम विष अधिष्ठान

दृष्टि निश्वास दंष्ट्रा नख मूत्र पुरीष शुक्ल लालार्तव ।

मुखसदंश विशर्दिद तुण्डस्थि पित्त शूकशवानीति ॥

(S.K. 3/4)

- | | |
|--------------------|----------------------|
| ❖ दृष्टि – Sight | ❖ शुक्र – Semen |
| ❖ निश्वास – Breath | ❖ लाल – Saliva |
| ❖ दंष्ट्रा – Fangs | ❖ मुख सदंश – Pincers |
| ❖ नख – Nails | ❖ विशर्दिद – Vomitus |
| ❖ मूत्र – Urine | ❖ तुण्ड – Beak |
| ❖ पुरीष – Faeces | ❖ अस्थि – Bone |

❖ पित्त – Bile

❖ शूक – Hair

❖ शव – cadaver

❖ अर्तव – Menstrual blood

1.4 Difference between Poison, Venom and Toxin

These are distinguished through their delivery route. (See the table below)

1.5 Routes of administration of Poison

Routes of administration mean the way in which poison enters the body.

1. **Enteral route:** Poison may enter the body, through mouth or rectum, to be absorbed across the enteral (GIT) mucus membrane. The primary site of drug absorption is small intestine, and the action of the poison depends on the amount of poison absorbed across the intestinal epithelium.
2. **Parenteral Route:** Other than enteral route, through, poison may enter the peripheral or central nervous system :
 - **Injection:** Administration of poison through injections, includes following routes: subcutaneous (under the skin), intramuscular (into a muscle), intravenous (into a vein) and intra-theal (around the spinal cord).
 - **By inhalation** through the nasal passages.

Poison	Venom	Toxin
Enters the body through swallowing, inhaling, or absorption through the skin.	Enters the body through bites and stings. (through an injury)	Specific proteins produced within the cells of organisms, or collected from the environment passively enter the body.
Physical chemical or mechanical in type.	Injected directly into a victim either through fangs or teeth (bites), stings (scorpion).	Example: Mushroom toxin and tetanus toxin.
Effects may vary acute or chronic.	Active delivery into the blood stream.	Instantaneous effects
Example: acids, alcohol, arsenic.	Snake bite, scorpion stings Used for offence to catch prey.	They are usually used for defense to detect predators or competitors.
	Venom is a mixture that will include toxin.	Usually single molecule not a complex one.

- Application through a wound, or serous surface or through Broncho-tracheal mucus membrane.
- Introduction into natural orifices, like vagina, urethra, nose, eyes, etc.
- Sublingual route.

Rapidity of action of poison depends on the route of administration.

1.6 Mode of Action of Visha (Visha gunanusara karma) and Poison (Introduction to Toxicokinetics)

Visha Kriya/Visha Pranahara Kriya

(विष क्रिय/विष प्राणहरक्रिया/विष कार्मुकत)

According to Sushrutacharya

तत् रौक्ष्यात् कोपयेत् वायुं औष्ण्यात् पित्तं स शोणितम् ।
मतिं च मोहयेत् तैक्ष्ण्यात् मर्मबन्धान् छिनत्ति च ॥
शरीरावयवान् सौक्ष्म्यात् प्रविशेद्विकरोति च ।
आशुत्वात् आशु तद्धन्ति व्यवायात् प्रकृतिं भजेत् ।
क्षपयेच्च विकाशित्वाद् दोष धातून्मलानपि ॥
वैशद्यात् अतिरिच्येत दुश्चिकित्स्यं च लघवात् ।
दुर्हरं चाविपाकत्वात् तस्मात् क्लेशयते चिरम् ॥

(S. K. 20-23)

(See the table below)

Action of Poisons (Introduction to Toxicokinetics)

Toxicokinetics

Toxicokinetics denotes the response of our body towards a poison. It is the study

of kinetics of absorption, distribution, metabolism, and excretion of a xenobiotic (foreign substance or poison) under the conditions of toxicity evaluation.

ADME: Absorption, Distribution, Metabolism and Elimination are the steps in toxicokinetics.

Toxicodynamics

It is the study of effects of toxins or chemicals in the body. It includes signs and symptoms caused by a chemical in the body.

1. Absorption of Poisons

- ❖ Before a poison can exert a toxic effect on the body it must come in contact with biological system.
- ❖ Rate and site of absorption may be an important factor, in the eventual toxicity compound and the absorption depends on the transport mechanism or passage through various cell membranes.
- ❖ Membranes are composed mainly of phospholipids, and proteins. They are selectively permeable and depend on their molecular size lipid solubility.

Transport mechanism of poisons done by mainly:

- A. Filtration:** Small molecules may pass through the pores of membrane.

S. No.	Guna	Actions	Actions
1.	Rookshata	कोपयेत् वायुम्	Vitiates vata
2.	Ushnata	कोपयेत् पित्तम् शोणितम्	Vitiates pitta and raktha
3.	Theekshnatha	छिनत्ति मर्मम् मोहयेत् मतिम्	Derranges mind and disintegrates marma
4.	Sookshmata	शरीरावयवान् प्रविशेत्	Enters minute pores of the body quickly
5.	Asu	हन्ति शरीरम् आशु	Instantaneous action in the body
6.	Vyavayi	प्रकृतिम् भजेत्	Derranges normality of body very quickly
7.	Vikasi	दोष धातु मल क्षणम्	Causes destruction of dosha dhatu and mala
8.	Visada	अतिरिच्येत	Does not stay in one part of the body
9.	Laghu	दुश्चिकित्स्येत्	Difficult to cure
10.	Avipaki	दुर्हरं	Difficult to eliminate from the body

B. Passive diffusion: To occur passive diffusion, there must be a concentration gradient across membrane, the foreign molecule must be lipid soluble and the compound must be ionised.

C. Active Transport: This is done when:

- A specific membrane carrier is required.
- Metabolic energy is required.
- Transport occurs against a concentration gradient.
- Similar substrate compete for uptake.

D. Facilitated diffusion: Unlike active transport, no energy expenditure is necessary here.

E. Phago-cytosis and pino-cytosis: It involves the invagination of membrane to enclose a particle or droplet respectively.

Major sites of absorption of Toxins

1. GIT
2. Lungs
3. Skin

2. Distribution

After entry into the body, the chemical will be distributed to different tissues and organs, depending on where it has entered the body and its chemical properties.

E.g.: A substance entering through skin can be taken up by the lymphatic system and it first reaches lymph nodes, before other organs under the skin.

A substance entering through the lungs directly comes into the blood stream and reaches the heart as the first organ after the lungs.

As another e.g.: Substance which is highly hydrophobic eventually accumulates in the body fat, in contrast to hydrophilic substance. Such substances accumulated in fat tissues can be released relatively in

large when amount fat is digested fasting, diet, or during breast feeding to babies. They are more exposed to lipophilic substances.

Distribution depends on 3 factors

1. The binding of substance to plasma proteins.
2. Partition between blood and specific tissues.
3. Permeability of substances to cross specialized barrier.
E.g.: Blood brain barrier

3. Metabolism

Mainly in the liver also to some extent in other organs, such as the gut and the lungs, chemical can be converted to other substances (metabolism or biotransformation) by specific enzymes. These enzymes are meant to convert the "useful" nutrient to the necessary forms to be used by the body and convert harmful toxins to harmless substances that can be quickly removed from the body. However, these conversions can also lead to a more toxic substance than the original substance absorbed which is called Bio activation.

The general aim of metabolic system is to make the substance more hydrophilic, so that they can dissolve well in the blood and is distributed to the target organs (nutrients) or to make them more easily executed through urine or bile.

(Endogenous waste or xenobiotic chemical)
In general the metabolic reactions can be clustered into—

Phase 1 reaction: (Oxidation, Reduction, and Hydrolysis)

It introduces a polar group into the molecule

Phase 2 reaction: It attaches (conjugate) an endogenous and hydrophilic substance to the molecule. E.g.: Glutathione

4. Excretion

Finally a substance is removed (eliminated/cleared) from the blood via metabolism or excretion. Removal through the faeces (including bile), urine, breath, and to a lesser extent excretion of a substance depends on its physical and chemical properties.

E.g.: Volatile compounds will quickly leave the body through exhalation. Hydro-philic substances remain dissolved in the urine and are hardly reabsorbed in the kidney tubules. Majority of larger substances are mainly excreted through the bile into the intestines and are subsequently excreted through faeces or reabsorbed into the body. Transport of polar substances from the liver to the bile takes place through active transport ation.

Action of Poison

1. Local
2. Remote
3. Local-Remote/Combined
4. Systemic
5. General

1. Local Action

Local action results from the direct action of a poison on any local part of the body. These poisons can have destructive effects on local tissues and produce gross changes which can be seen through naked eye or in Postmortem examination.

E.g.: Corrosion due to strong mineral acids and inflammation due to irritants.

2. Remote Action

Remote action affects the person due to the absorption of the poison into the biological system of that person. For example: Poison like alcohol is absorbed into the system and causes bad effects.

It is of two types

A. Specific: Poison has special affinity towards certain organs.

E.g.: Strychnine on spinal cord and digitalis on heart.

B. Non-specific: Apart from the affinity towards any particular organ, it produces certain non-specific action.

E.g.: Shock in corrosive poisons.

3. Local and Remote action/Combined action

Some poisons produce both local and remote actions. They cause destructive effects on local tissues and also cause toxic effects after absorption.

E.g.: Oxalic acid and corrosive acids.

4. Systemic Action

Systemic poisons affect the whole body or multiple sites rather than a particular organ or site.

E.g.: Lead poisoning.

5. General Action

Absorbed poison evokes response from variety of tissues beyond the limits of one or two systems.

E.g.: Arsenic, mercury, DDT, etc.

1.7 Factors Modifying the Action of Poison

There are four factors:

- ❖ Quantity
- ❖ Form
- ❖ Mode of Administration
- ❖ Condition of the Body.

1. Quantity/Dose

Generally larger the quantity of poison, more severe is the action of poison in the body. Anyhow sometimes the poison, if large quantity is taken, may be eliminated from the body through vomiting. The action of the poison varies with the dose. Therefore, the

cause of death due to large quantity poison and small quantity poison may be different.

2. Form of Poison

❖ **Physical combination:** A substance is generally more poisonous when it is in gaseous state or in vapour. Liquid poisons act faster than solids, out of which fine powders act more quickly than coarse ones.

❖ **Chemical combination:** The action depends on solubility or insolubility with some solutions or reagents resulting from the chemical combination.

E.g.: Silver nitrate and hydrochloric acid are both strong poisons but when combined, they form an insoluble salt which may be harmless.

3. Mode of Administration

Route of administration of poison affects the action of poison.

Inhalation/gas/vapors > IV > IM or subcutaneous injections > Oral > Rectal

4. Condition of the Body

A. Age: Poison has a greater action in children and old age.

B. State of health: A healthy person tolerates poison better than diseased person.

C. Sleep and intoxication: Action of poison is delayed in sleep or in intoxicated state.

D. Idiosyncrasy: There is an inherent hypersensitivity to the poisonous agent in question, resulting in symptoms like dyspnoea, rigors, fever, and diarrhoea.

E.g.: Penicillin, aspirin, sulphonamides and cocaine.

E. Habit tolerance: By habitual intake, tolerance can build up to substance and the same dose may have no effect.

E.g.: Alcohol, tobacco and barbiturates.

F. Cumulative Action: If not excreted and given in repeated doses, a poison can accumulate in the body and produce symptoms on reaching threshold concentration.

In Ayurveda, this concept can be very much relatable with Dooshivisha.

1.8 Vishavardhaka Bhavas & Visha Sankata

Vishavardhaka Bhavas

क्षुत्तृष्णाघर्म दौर्बल्य क्रोधशोकभयश्रमैः ।

अजीर्णवर्चोद्वेगतापित्तमारुतवृद्धिभिः ॥

तिलपुष्पफलघ्राणभूबाष्पघनगर्जितैः ।

हस्तिमूषिकवादित्रनिस्वनैर्विषसङ्कटैः ॥

पुरोवातोत्पलामोदमदनैवर्धते विषम् ।

(A.H. U.36/61-62)

The effect of poison increases by these factors— Hunger, thirst, increased heat, weakness, anger, grief, fear, exertion, indigestion, watery faeces, increase in pitta and vata, smelling the flowers and fruits of madanaphala, by fumes of earth, thunder, sound of elephant, squeaking of mice, sound of musical instruments, during visha sankata, east breeze, fragrance of utpala, sexual desire etc.

Here among these factors, some factors increase visha by its *prabhava*, some of them vitiate vata and pitta dosha which in turn increase visha.

Visha Sankata

विष प्रकृति कलान्न दोष दूष्यादि सङ्गमे ।

विष सङ्कटमुद्दिष्टं शतस्येकोत्र जीवति ॥

(A. H. U. 36/60)

In case of combination of all the factors like, visha prakruti, visha anna, dosha and dooshya, during a specified period which is called Visha Sankata/Fatal period, one out of 100 people survive.

1. विष प्रकृति - पित्त प्रकृति

2. विष काल - वर्ष ऋतु
3. विष अन्न - सर्षपादि - तीक्ष्ण आहार
4. विष दोष - पित्त दोष
5. विष दूष्य - रक्त
6. आदि - सात्म्य

1.9 Visha vega, Vegantara and Sthavara Visha veganusara lakshana and chikitsa

Visha Vega

धत्वान्तरेषु याः सप्त कलाः संपरिकीर्तिताः ।
तास्वैकैकामतिक्रम्य वेगं प्रकुरुते विषम् ॥

(S.S. K. 4/40)

- ❖ The Visha after entering the body passes from one kala to another kala which are located in between dhatus and thus give rise to Vegas.
- ❖ According to Charakacharya, there eight Vegas:
- ❖ Death (Mrityu) is eighth Vega.
- ❖ Acharya Sushruta and Vagbhata explain seven vegas.
- ❖ Visha vegas are explained for birds and animals too according to Sushruta and Charaka.
- ❖ Acharya Charaka explains four vegas for animals and three for birds.

Vegantara

येनान्तरेण तु कलां कालकल्पं भिनत्ति हि ।
समीरणो नो ह्यमानं तत्तु वेगान्तरं स्मृतम् ॥

(S. S. K. 4/41)

The time interval as the poison driven by vata dosha, crosses from one kala to other kala and is turned as **Vegantara** (Intervening Stage).

Sthavara Visha Vega Lakshana and Chikitsa

Visha Vega Lakshana and Chikitsa according to Sushrutacharya:

1. First Vega

स्थावरस्योपयुक्तस्य वेगे तु प्रथमे नृणाम् ।

श्यावा जिह्वा भवेत् स्तब्धा मूर्च्छा श्वासश्च जायते ॥

(Su.Kal. 2/34)

श्यावत	Bluish discolouration of tongue
स्तब्धत	Unable to move the tongue
मूर्च्छा	Fainting
श्वास	Dyspnoea

2. Second Visha Vega

द्वितीये वेपथूः सादो दाहः कण्ठरुजस्थः ।

(Su.K. 2/35)

वेपथु	Shivering of body
साद	Weakness of body
दाह	Burning sensation
कण्ठ रुज	Throat pain

3. Third Visha Vega (in Amaashaya)

विषमामाशयं प्राप्तं कुरुते हृदि वेदनाम् ।

तालुशोषं त्रितीये तु शूलं चामाशये भृशम् ॥

दुर्बर्णे हरिते शूने जायते चास्य लोचने ॥

(Su.K. 2/35-36)

हृदि वेदनां	Pain in the heart/chest area
तालु शोष	Dryness of the palate
आमाशय शूलम्	Severe pain in the stomach
हरित शून लोचन	discolouration and swelling in the eyes

4. Fourth Visha Vega

(Pakvaashaya gata lakshana)

पक्वामाशयोस्तोदो हिक्का कासोऽन्नकूजनम् ।

चतुर्थे जायते वेगे शिरसश्चातिगौरवम् ॥

(Su.K. 2/37)

पक्वाशय तोद	Pricking Pain in stomach & intestine
हिक्का	Hiccough
कास	Cough
आन्नकूजनं	Intestinal gurgling
शिरोगौरवं	Feeling of severe heaviness of head

5. Fifth Visha Vega

कफप्रसेको वैवर्ण्यं पर्वभेदश्च पञ्चमे ।

सर्वं दोषं प्रकोपश्च पक्वाधाने च वेदना ॥

(Su.K. 2/38)

कफप्रसेक	More elimination of kapha
वैवर्ण्यं	Discolouration
पर्वभेद	Joint pain
सर्वं दोषं प्रकोप	Vitiating of all dosha

6. Sixth Visha Vega

षष्ठे प्रज्ञा प्रणाशश्च भृशं चाप्यतिसार्यते ।

(Su.K. 2/39)

प्रज्ञा प्रणाश	Unconsciousness
भृशं चाप्यतिसार्यते	Severe diarrhoea

7. Seventh Visha Vega

स्कन्ध पृष्ठ कटी भङ्गः सन्निरोधाश्च सप्तमे ।

(Su.K. 2/39)

स्कन्ध पृष्ठ कटी भङ्ग	Cutting pain in shoulder, back, pelvis
सन्निरोधा	Complete stoppage of breathing

Veganusara Chikitsa

प्रथमे विषवेगे तु वान्तं शीताम्बुसेचितम् ।

अगदं मधुसर्पिर्भ्यां पाययेत् समायुतम् ॥

द्वितीये पूर्ववद्वान्तं पाययेत्तु विरेचनम् ।

तृतीये अगदपानं तु हितं नस्यं तथाऽञ्जनम् ॥

चतुर्थे स्नेहसंमिश्रं पाययेत्तागदं भिषक् ।

पञ्चमे क्षौद्रं मधुकक्वाथयुक्तं प्रदापयेत् ॥

षष्ठे अतिसारवत् सिद्धिरवपीडश्च सप्तमे ।

मूर्ध्नि काकपदं कृत्वा सासृग्वा पिशितं क्षिपेत् ॥

(Su.K. 2/40-43)

- ❖ **1st Vega Chikitsa:** Vamana, pouring of cold water and administer antipoisnous medicines.
- ❖ **2nd Vega Chikitsa:** Vamana, Virechana, Administer antipoisnous medicines.
- ❖ **3rd Vega Chikitsa:** Administer antipoisnous medicines internally, Anjana and Nasya.
- ❖ **4th Vega Chikitsa:** Administer antipoisnous medicines internally with ghee and honey.
- ❖ **5th Vega Chikitsa:** Administer antipoisnous medicines internally with honey decoction of madhuka.
- ❖ **6th Vega Chikitsa:** Managements like diarrhoea and avapeeda nasya.
- ❖ **7th Vega Chikitsa:** Kakapada chikitsa (wound is made on the head, resembling the claws of cow) and a piece of meat having blood in it should be placed on the wound.

Visha Vega According to Charaka

तृणमोहदन्तर्हर्षप्रसेकवमथुक्लमा भवन्त्याद्ये ।

वेगे रसप्रदोषादसृक्प्रदोषाद्वितीये तु ॥

वैवर्ण्यभ्रमवेपथुमूर्च्छाजृम्भाङ्गः चिमिचिमातमकाः ।

दुष्टपिशितातृतीये मण्डलकण्डूश्चयथुकोठाः ॥

वातादिजाश्चतुर्थे दाहच्छर्द्याङ्गशूलमूर्च्छाद्याः ।

नीलादीनां तमसश्च दर्शनं पञ्चमे वेगे ॥

षष्ठे हिक्का, भङ्गः स्कन्धस्य तु सप्तमे अष्टमे मरणम् ।

(C. Ch. 23/18-20)

Vega	Location	Signs and Symptoms	Treatment
1.	Rasa	Thrishna (Thirst) Moha (Mental Confusion) Danta harsha (Sensitivity to teeth) Praseka (Excessive Salivation) Klama (Exhaustion) Vamathu (Vomitting)	Vamana

Vega	Location	Signs and Symptoms	Treatment
2.	Rakta	Vaivarnya (Discolouration of the skin) Bhrama (Giddiness) Vepathu (Trembling) Murcha (Fainting) Jrumbha (Yawning) Angama Chimichima (Tingling)	Virechana
3.	Mamsa	Mandala (Circular patches) Kandoo (Itching) Svayadhu (Swelling) Kota (Urticaria)	Ksharagada with madhu and ambu
4.	Vatadhi dosha	Daha (Burning Sensation) Chardhi (Vomiting) Angashoola (Body pain) Murcha (Fainting)	Gomaya rasa along with kapitha, madhu and sarpi
5.		Neeladheenam thamas darsanam (one sees the object as blue)	Aschotana Anjana Nasya with kakanda swarasa
6.		Hikka (hiccup)	Sanja samsthapana
7.		Skandha bhagna (falling or drooping of shoulder)	Visha pana in case of damshtra visha, sarpadamsa in case of vishapaana
8.		Maranam (death)	

1.10 Visha Peeta and Visha Mukta Lakshanas

Visha peeta lakshana (Features of poison intake)

सवातं गृहधूमाभं पुरीषं योऽतिसार्यते ॥
आध्मातोऽत्यर्थमुष्णास्त्रो विवर्णः सादपीडितः ।
उद्धमत्यथ फेनं च विषपीतं तमादिशेत् ॥
न चास्य हृदयं वह्निर्विषजुष्टं दहत्यपि ।
तद्धि स्थानं चेतनायाः स्वभावादव्याप्य तिष्ठति ॥

(S. K. 3/ 35-37)

Critically poisoned person eliminates faeces accompanied with flatus. The faeces resembling chimney soot (black in colour) is liquid and expelled many times as diarrhoea. The patient has great distention of the abdomen, sheds warm tears, is discoloured, debilitated, and emitted froth from his mouth. The patient with these symptoms should be understood as one

who has consumed poison; even fire will not burn the heart filled with poison, since by nature it is the seat of *chetana* (soul) filled with poison now.

Visha mukta lakshanas

प्रसन्नदोषं प्रकृतिस्थधातु मन्नाभिकाङ्क्षं समसूत्रजिह्वम् ।
प्रसन्नवर्णेन्द्रियचित्तचेष्टं वैद्योऽवगच्छेदविषं मनुष्यम् ॥

(S. K. 6/32)

- ❖ **Prasanna dosha:** Balanced dosha which constitute the body (vatadi doshas in normalcy).
- ❖ **Prakritistha dhatu:** Balanced rasadi dhatus and malas of the body.
- ❖ **Annabhikaaksha:** Good feel of appetite.
- ❖ **Samasootra jihwa:** No pathology in the body.
- ❖ **Prasanna varna indriya chitta cheshta:** Very normal complexion of the body, senses are in normal, mind normal, activities normal (no pathology underlined).

Summary

- ❖ **Agada Tantra:** It is one among the Ashtangas of Ayurveda which deals with different types of poison and its toxicity and their management, treatment. So various types of Toxicology including environmental Toxicology comes under this.
- ❖ **Clinical toxicology:** It is the branch of science involves the detection and treatments of poisoning caused by a wide variety of substance, including household and industrial products, animal poisons and venoms, environmental agents, pharmaceutical and illegal drugs.
- ❖ **Poison:** It is any substance capable of producing deleterious response in a biological system seriously injuring function or producing death.
- ❖ **Factors influencing the action of poison:** Dose, form of poison, method of administration and condition of the body.
- ❖ **Types of poisoning:** Fulminant (massive dose poison), acute (a single large or several small doses), chronic (small doses taken over a long period of time).
- ❖ **Mechanism of poisoning:** Poisons produce either local or systemic effects. They act by increasing or decreasing the body functions or secretions; e.g: heart rate, respiratory rate, salivation, lacrimation, sweating, and urination. Poison also causes bio chemical change resulting in physiological change.

Classification of poisoning

1. Corrosives

- Strong acids – Organic acids and inorganic acids.
- Strong alkalies

2. Irritants

• Organic irritants

- ♦ Plant irritants: Abrus, Ricin
- ♦ Animal irritants: Snake venom, Cantharides.

• Inorganic irritants

- ♦ Metallic irritants: Mercury, Arsenic
- ♦ Nonmetallic irritants: Phosphorus, Halogens.

• Mechanical irritants: Powdered glass, Diamond dust.

3. Neurotoxic

• Cerebral neurotoxic

- ♦ CNS stimulant: Amphetamines, Tricyclic antidepressants.
- ♦ CNS depressant:
 - A. Inebriants: Alcohol, Sedative hypnotics.
 - B. Somniferous(narcotics): Opioids
- ♦ Deliriant: Datura, Cocaine

• Spinal: Spinal stimulant (Strychnos) & Spinal depressant (Gelesmium)

• Peripheral: Curare & Hemlock.

4. Poisons affecting organs:

- **Cardiac:** Aconite, Digitalis
- **Hepatotoxic:** Ethanol, Phosphorus
- **Nephrotoxic:** mercuric chloride, carbolic acid.

5. Asphyxiants: Carbon monoxide (CO), cyanide, CO₂.

- ❖ **Scope of Agadatantra:** Protection of healthy individuals from poisoning and management of individuals affected with poison.

- ❖ **Visha:** It is that which enters the body causes dhatu Pradooshana (vitiation

of dhatu) and causes the death of the organism immediately.

- ❖ **Visha guna:** Visha is having 10 gunas which is similar to those of madya and opposite of ojus.
- ❖ **Visha gati:** The jangama vishas are having adho gati (downward movement) in the body whereas the sthavara vishas have urdhva gati (upwards direction). Therefore the varieties neutralizes their action each other.

Difference between poison, venom and toxin:

- ❖ **Toxin is a chemical substance produced within living cells or organisms.** Ex: virus proteins.
- ❖ **Poison is a substance that can cause illness or death when absorbed or ingested,** Ex: fungus, ricin.
- ❖ **Venom is a substance produced by an animal for self-defense and is injected into another animal.**

Vishavardhaka bhavas

The effect poison increases by these factors are hunger, thirst, increased heat, weakness, anger, grief, fear, exertion, indigestion, watery feces, increase in pitta and vata, smelling the flowers and fruits of madanaphala, by fumes of earth, thunder, sound of elephant, squeaking of mice, sound of musical instruments, during visha sankata, east breeze, fragrance of utpala, sexual desire etc are the factors.

Vishasankata

Combination of all the factors like, visha prakriti, visha anna, dosha, dooshya, during a specified period which is called Visha Sankata/Fatal period and in such fatal

period of visha one out of 100 people will survive.

Visha vega

The Visha after entering in to the body passes from one kala to another kala which are located in between dhatus and thus give rise to Vegas

The number of vegas are mentioned – seven.

Visha vegantara

The time interval as the poison driven by vata dosha, crosses from one kala to other kala, is turned as Vegantara (Intervening Stage).

Visha peeta lakshana

Critically Poisoned person eliminated faeces accompanied with flatus, the faeces resembling chimney soot (black in colour), liquid and expelled many times as diarrhea, who has great distention of the abdomen, sheds warm tears, is discoloured, debilitated, and emitting froth from his mouth-should be understood as one consumed poison; even fire will not burn the heart filled with poison, since by nature it is the seat of chetana (soul) filled with poison now.

Visha mukta lakshanas

Prasanna dosha (balanced dosha constitution of the body), Prakristha dhatu (normal dhatus), Annabhikaamsha (feeling of good appetite), Samasootra jihwa (clear taste (no diseases), Prasanna varna indriya chitha cheshta (very normal complexion of the body, senses are in normal, mind normal, activities normal (no pathology underlined)

Important Questions

MCQ

1. Gunas of Madya is similar as visha except:

- a. Vyavayi c. Rasa
b. Laghu d. Visada

2. The time taken by visha from one dhatu to another is:

- a. Kala c. Vegantara
b. Vega d. Vakshana

3. Dushchikitsita is the karma of visha attained by which guna:

- a. Vyavayi c. Laghu
b. Sookshma d. Teekshna

4. Examples of peripheral poisons are:

- a. Stychnos nuxvomica
b. Alcohol
c. Conium
d. Aconitum

5. Among the following, which one is actively delivered into the body?

- a. Poison c. Venom
b. Toxin d. Virus

6. Ksharagada is mentioned in which vega chikitsa:

- a. Third c. Sixth
b. Fourth d. Seventh

7. Avapeeda nasya is mentioned in:

- a. Third c. Sixth
b. Fourth d. Seventh

8. Colour of faeces in vishapeetha lakshana

- a. Syava
b. Pandu
c. Peetha
d. Grihadhooma like

9. One among hundred people survives in case of:

- a. Sarpa visha
b. Sanka visha
c. Sarpangabhihata
d. Visha sankata

10. Which among the following is not a cause for visha vriddhi?

- a. Kshut
b. Ajeerna
c. Kapha vriddhi
d. Smell of tila pushpa

Answer key

1. c	2. c	3. c	4. c	5. c
6. a	7. d	8. d	9. d	10. c

Learning Objectives

- Define Agadatantra, its scope in present era, define Visha, and differentiate poison, toxin and venom.
- Explain the Classification of Visha or poison, its administration, visha gunas and its comparison with gunas of madya and ojus.
- Explain about toxicokinetics and toxicodynamics.
- Explain about visha vardhaka bhavas & visha sankata.
- Explain about visha vega, sthavara visha vega and its chikitsa.
- Describe about visha peeta and visha mukta lakshanas.

Important SAQ

- What are visha peeta lakshanas?
- What are the routes of administration of poison?
- Explain Visha sankata.
- What is Toxicokinetics?
- Differentiate between visha Madya and ojus.

Important LAQ

- Explain about Gunas and karmas of visha in the body (mode of action of visha).
- What is the Scope of Agadatantra?
- Explain sthavara visha vegas with its management.
- What are the factors modifying the action of poisons?
- Describe the classification of poison.

• • •

Visha Chikitsa (Management of Poisoning)

2.1 Diagnosis of Poisoning in Living and Dead

Diagnosis of poisoning is challenging and time consuming because it is achieved with the evidences available. In some instances, the history may not be available or unreliable. Various cases of poisoning present ambiguous symptom, in some cases symptoms may be delayed even in acute poisoning and some poisons develop misleading symptoms, for example symptoms occurred in GIT in arsenic poisoning may be mistaken for symptoms of cholera or food poisoning. Thus, the diagnosis has to be done based on clinical features as well as laboratory examinations.

Signs and Symptoms of Poisoning

Symptoms	Poisons causing
Vomiting and diarrhoea	Organic irritant plant poisons, arsenic, acids and alkali poisons
Cramps	Metallic poisons like arsenic, lead, antimony and mercury
Delirium	Datura, cannabis, alcohol, atropine etc.
Convulsions	Strychnine, nicotine, cyanide, tricyclic anti-depressants, carbon monoxide, opioids, organophosphate insecticides

Symptoms	Poisons causing
Paralysis	Lithium, arsenic, lead, aconite, snake venom
Coma	Barbiturates, CO, opioids, chloroform

Clinical Diagnosis of Poisons

Clinical signs	Poison involved
Skin colour	Cherry pink: CO Flushed pink colour: alcohol, cocaine, cyanide, anticholinergic drugs Jaundice: hepato toxic agents like paracetamol
Skin changes	Cutaneous bullae: barbiturates, carbon monoxide Sweating: organo phosphates
Pupils	Myosis (constricted pupil): (Mnemonic: cooba) carbolic acid, opioids, organophosphates, barbiturates, antipsychotics Mydriasis (dilated pupil): (Mnemonic: DAAM) deliriant, asphyxiants, anticholinergic anti histamine, miscellaneous
Body temperature	Hypothermia: sedatives, Hypnotic drugs, ethanol, opioids Hyperthermia: It is caused by heat stroke, meningitis, poisoning by anti-cholinergic agents, carbon monoxide, datura, phenols

Clinical signs	Poison involved
Odour	Cyanide: Bitter almond smell Cannabis: Burnt rope Aluminium phosphide: Fishy smell Organo phosphorus: Kerosene smell Hydrogen sulphide: Rotten egg Arsenic: Kerosene smell Nitrobenzene: Shoe polish
Froth	Cocaine, opioids, organo-phosphates, barbiturates
Blood pressure	Hypertension: Amphetamines, cocaine Hypotension: Almost all sedatives, hypnotics, dehydration may causes hypotension
Cardiac arrhythmias	Changes in heart rate or rhythm may be caused by beta blocking drugs, organophosphates, theophylline, barbiturates

Postmortem findings in case of poisoning

Poisoning is medico legal in nature. If the patient dies, postmortem examination has to be conducted to find out the cause and manner of death and also to collect the evidences.

In case of poisoning, a **peculiar smell** depending on the type of poison involved is emitted from the body while opening the body cavity. Depending on the poison, alcoholic, kerosene smell and burnt rope smell are commonly occurred. Apart from these, the **presence of any foreign material** like powder, capsule, tablets, seeds etc. may be present. Irritation, ulceration perforation and discolouration in the stomach mucosa are seen in irritant or corrosive poisoning. Carbolic acid poisoning causes hardening and shrinkage of mucus membranes. The perforation stomach is seen in strong acids like sulphuric acids, and also black in colour, with extensively damaged mucosa. The aperture is large with irregular edge and coats are lacerated through which acid escapes to the peritoneal cavity causing acute peritonitis.

Chemical analysis

In all the cases of death due to poisoning, an attempt must be made to demonstrate the occurrence of poison by various analytical methods. The doctor who performs autopsy must collect all the evidences like viscera and body fluids and send to the nearest FSL through police officer. While collecting and storing, it should be kept in suitable preservative media and suitable sealed containers. Also, histo-pathological examinations have to be conducted as poison causing various types of degenerative changes in target organs or other organs. Excreta, blood and viscera have to be analyzed microscopically for the poison.

Analytical techniques for diagnosis of poison

Spectrometric methods of analysis:

- ❖ Calorimetric
- ❖ Fluorimetric
- ❖ Automation

Chromatographic methods

- ❖ Thin layer chromatography (TLC)
- ❖ Gas liquid chromatography (GLC)
- ❖ High performance liquid chromatography (HPTLC)
- ❖ Gas liquid mass spectrometry (GL-MS)

Immune active assays

- ❖ Radio immune assay (RIA)
- ❖ Enzyme immune assay (EIA)
- ❖ Fluorescent polarization immunoassay (FPIA)

2.2 Chaturvimshati Upakrama

Vishopakrama by Charaka - Chaturvimshati Upakrama

मन्त्रारिष्टोत्कर्तननिष्पीडनचूषणाग्नि परिषेकाः ।

अवगाहरक्तमोक्षणवमनविरेकोपधानानि ।।

हृदयावरणाञ्जननस्यधूमलेहौषधप्रशमनानि ।

प्रतिसारणं प्रतिविषं संज्ञासंस्थापनं लेपः ।।

मृतसञ्जीवनमेव च विंशतिरेतेचतुर्भिरधिकाः ।

स्युरूपक्रमा यथा ये यत्र योज्या शृणु तथा तान् ॥

(C. Ch. 23/35-37)

1.	Mantra	Recitation of mantra
2.	Arishta	Tying ligature
3.	Utkartana	Excision of bite site
4.	Nishpeedana	Squeezing of blood from bite site
5.	Chooshana	Sucking out blood from bite site
6.	Agni	Cauterization
7.	Parisheka	Irrigation
8.	Avagaaha	Immersion of bite site in medicated water
9.	Rakta mokshana	Blood letting
10.	Vamana	Emesis
11.	Vireka	Purgation
12.	Upaadhana	Application of medicines after incision of scalp/sole
13.	Hridayaa-varanam	Protection of heart
14.	Anjana	Collyrium
15.	Nasya	Nasal inhalation
16.	Dhooma	Fumigation
17.	Leha	Drugs in the form of linctus
18.	Oushadha	Anti-toxic drugs
19.	Prasamana	Conservative treatments
20.	Pratisarana	Rubbing with anti-poisonous powders
21.	Prativisha	Administration of poisons to counteract poisons
22.	Samja-sthapana	Restoration of consciousness
23.	Lepa	External application of medicaments
24.	Mruta sanjeevana	Revival of apparently dead persons

1. मन्त्र (Recitation of Mantra)

मन्त्रस्य विषहरेषु श्रेष्ठत्वादग्रे अभिधानम् ।

Mantra is said to be superior among all method to alleviate visha. – Chakrapaani

According to Sushruta Samhita

विषं तेजोमयैर्मन्त्रैः सत्यब्रह्मतपोमयैः ।

यथा निवार्यते क्षिप्रं प्रयुक्तैर्न तथौषधैः ॥ (Su. K. 5/10)

Mantras/hymns are said to be full of *tejas* (power) and chanted by persons, who indulge always in truth, spiritual knowledge, and penances only will cures poison quickly but not medicines quickly.

2. अरिष्ट Arishta Bandha (Tying Ligature)

Two types of Arishta

1. Arishta impregnated with mantra:

अरिष्टामपि मन्त्रैश्च बन्धनीयान् मन्त्र कोविदः ।

(Su. K. 5/8)

2. Rope or string tied above the proximal part of bite without mantra.

दंशस्योपरि बन्धनीयादरिष्टां चतुरङ्गुले ।

क्षौमादिभिर्वेणिकया सिद्धैर्मन्त्रैश्च मन्त्रवित् ॥

अम्बुवत् सेतुबन्धेन बन्धेन स्तभ्यते विषम् ।

न वहन्ति सिराश्चास्य विषं बन्धाभिपीडिताः ॥

(A. H. U. 36/42-43)

Tourniquet or ligature is tied 4-angula above bite site with rope of flax etc. An arishta should be made from threads of flax or hair. By this the poison stops spreading just as flow of water by the dam, blood vessels do not transport the poison, being subjected to pressure by binding.

3. Utkartana (Excision of Affected area)

मात्राशतं विषं स्थित्वा दंशे दष्टस्य देहिनः ।

देहं प्रक्रमते धातून् रुधिराधीन् प्रदूषयत् ॥

एतस्मिन्नन्तरे कर्म दंशस्योत्कर्तनादिकम् ।

कुर्याच्छीघ्रं यथा देहे विषवल्ली न रोहति ॥

(A. H. U. 36/38-39)

Poison is retained in the bitten area for 100 matra :

- ❖ Then it spreads throughout body vitiating blood and other tissues.
- ❖ Within that time (100 matra) UTKARTANA should be done and also other treatment.

Charaka says

- ❖ दंशमुद्धरेत् मर्म वर्जम्।
- ❖ Should not be done in vital areas (marma)

Sushruta says

- ❖ दहेद्दंशं अधोत्कृत्य यत्र बन्धो न जायते।
- ❖ When arishta bandhana is not possible the bite site should be exercised and burnt.

4. निष्पीडन/ Application of pressure or squeezing out blood from bite site)

निष्पीड्यान्मुद्धरेद् दंशं मर्मसन्ध्यगतं तथा।
न जायते विषाद्वेगो बीजनाशादिवाङ्कुरः॥

(A. H. U. 36/44)

Bitten area: Massaged, teeth removed

- ❖ Not done in Marma region.
- ❖ Arrests spread of visha just as sprout does not develop after destroying the seed.

5. चूषणं (Sucking out poison from bite)

आचूषयेत् पूर्णवक्त्रो वा मृद् भस्मागदगोमयैः।

(A. H. U. 36/46)

Blood sucked through mouth filled earlier with mud, ash, anti-poisonous drugs or cow dung.

Charaka says

- ❖ तं दंशं वा चूषेन्मुखेन यवचूर्णं पांशु पूर्णेन।
- ❖ Mouth filled with barley flour or dust.
- ❖ By this poison does not come into direct contact with mouth.

Sushruta says

- ❖ प्रतिपूर्य मुखं वस्त्रैर्हितमाचूषणं भवेत्।
- ❖ स दृष्टव्योऽथवा सर्पो लोष्टो वाऽपि हि तत्क्षणम्॥

(S.K. 5/6)

- ❖ Achushana/chushana (sucking) should be done after filling the mouth with cloth, or the snake which has bitten or a piece of stone may be bitten immediately.

6. अग्नि (Cauterization)

दंशं मण्डलीनां मुक्त्वा पित्तलत्वादथापरम्।

प्रतप्तैर्हमलोहाद्यैर्दहेदाशूलमुकेन वा।

करोति भस्मसात्सद्यो वह्निः किं नाम तु क्षतम्॥

(A. H. U. 36/45-46)

- ❖ It should not be done in *mandali sarpa dashta*.
- ❖ Burnt with heated rods of hema, loha like metals or using a burning charcoal.
- ❖ Likewise fire turns everything into ash.

According to Charaka

त्वक् मांसं गतं दाहो दहति विषम्।

Cauterization causes burning of visha located in **twak and mamsa**.

According to Sushruta

दहेत् दंशं अधोत्कृत्य यत्र बन्धो न जायते।

When arishta abandhana can't be done, then **utkartana** and **dahana** are done.

Another context

While mentioning **Poisoned arrow**,

शल्यमकृष्य शस्त्रेण लोहेनानु दहेत् व्रणम्।

After pulling out *salya*, burn with heated rod or shastra.

Another context –lootha visha chikitsa

7. परिषेक (Irrigation)

रक्तं हि विषाधानं वायुरिवाग्नेः प्रदेहसेकैस्तत्।

शीतैः स्कन्दति तस्मिन् स्कन्ने व्यपयाति विषवेगः॥

विषवेगान्मदमूर्च्छाविषादहृदयद्रवाः प्रवर्तन्ते।

शीतैर्निवर्तयेत्तान् वीज्यश्चालोमहर्षात् स्यात्॥

(C. S. Chi. 23/42-43)

The blood is the vehicle of poison as the wind is for fire. With the help of *pradeha* and *seka* which are cooling in effect, the blood gets coagulated and arrests the spreading out of visha.

As a result of spreading of visha, the patient suffers from intoxication, fainting, depression and tachycardia. Application of cooling therapies, (*seetha pradeha* and *seetha parisheka*) alleviates such complication. The patient should be fanned till horripilation takes place, because of its cooling effect.

According to Ashtanga Hridaya

अस्कने विषवेगाद्धि मूर्च्छायमदहध्रुवा ।
भवन्ति तान् जयेच्छीतैर्वीजेच्चारोमहर्षतः ॥
स्कने तु रुधिरे सद्यो विषवेगः प्रशाम्यति ।

(A. H. U. 36/52)

If the blood has not clotted (at the site of bite) due to the effect of poison, fainting, toxicity, pain and palpitation of the heart occur, which should be controlled by cold therapies. The Patient should be fanned (expose to cold air) till he develops horripilations.

शीतोपचार शीत परिषेक, शीत सेक शीत प्रदेह ।

Sushruta says:

तृद् दाह घर्म सम्मोहे पैत्तं पित्तविषातुरम् ।

शीतैः संवाहनस्नानप्रदेहैः समुपाचरेत् ॥ (S. S. K. 5/38)

The person who has thirst, burning sensation, increased body temperature, delusion and other symptoms of pitta aggravation should be treated with cold things, massage, bath and poultice.

8. अवगाह (Bath with medicated water)

घृतमधुपयोऽम्बुपानावगाहसेकाश्च पित्तस्थे ।

(C.Ch. 23/62)

If poison is located in the site of pitta, the patient should be given ghee, honey, milk and water to drink. He should also be given bath and affusion.

9. रक्तमोक्षण (Blood letting therapy)

विवर्णे कठिने शूने सरुजेऽङ्गेः विषान्विते ।

तूर्णं विस्त्रवणं कार्यमुक्तेन विधिना ततः ॥ (S.K.5/36)

Poison affected and presented with discolouration, hard, swollen and painful and

bloodletting should be done quickly, according to the procedure mentioned earlier.

प्रच्छन्नशृङ्गः जलौकाव्यधनैः स्वाव्यं ततो रक्तम् ।
रक्ते विषप्रदुष्टे दुष्येत् प्रकृतिस्ततत्यजेत् प्राणान् ।
तस्मात् प्रघर्षणैरसुग्वर्तमानं प्रवर्त्य स्यात् ॥
त्रिकटुगृहधूमरजनी पञ्चलवणरोचनाः सवार्ताकाः ।
घर्षणमतिप्रवृत्ते वटादिभिः शीतलैर्लेपः ॥

(C.Ch.23/39-41)

Blood-letting should be performed with *prachana* (scratching with rough surfaced instruments), *Shringa* (application of horns), *jalauka* (application of leeches) or *sira vyadhana* (venesection, the blood afflicted with poison causes vitiation of other tissue elements in the body, leading to death. Therefore, if the blood does not come out of the bite site then *pragharshana* (rubbing therapy) should be employed to cause blood to flow out. For this, rubbing should be done with the help of powder of *sundi*, *pippali*, *maricha*, *griha dhooma*, *rajani*, *pancha lavana* (*souvarchala*, *saindhava*, *bida*, *oudbida*, *samudra lavana*) and *vartaaka* seeds.

A.H. says:

विषे प्रविसृते विध्येत्सिरां सा परमा क्रिया ।

रक्ते निर्हियमाणे हि कृत्स्नं निहियते विषम् ॥

(A. H. U. 36/48-49)

When the poison has spread in the body the vein should be cut and blood let out. This is the best treatment when vitiated blood is taken out, the person also comes out.

Extra points:

- ❖ Place of venesection is *saakhagra* or *lalada* (extremities & forehead)
- ❖ दर्वीकर-अथ दर्वीकृतां वेगे पूर्वे विस्त्राव्य शोणितम् । (in 1st vega)
- ❖ राजिल - *Prachana* and *alabu* in 1st vega
- ❖ आद्येवगाढं प्रच्छय वेगे दष्टस्य राजिलैः ।
अलाबुना हरेत् रक्तं पूर्ववच्चागदं पिबेत् ॥

(A. H. U. 36/80)

❖ Loota visha - सर्वतो अपहरेद्रक्तं शृङ्गः अर्धैसिर-
यापिवा। (sira vyadha, shringa visha)

❖ In Mushika visha and vrischika visha
rakta mokshana is mentioned.

According to Charaka-rakta mokshana is
indicated in these conditions like

कफस्थानगते विषम्।

रक्तस्थिते विषम्।

दूषिविषे।

Contraindications

गर्भिणि बाल वृद्धेषु मृदु विध्येत् सिरां न च।

(A. S. U. 42/56)

Siravyadha should not be done in

❖ Garbhini ❖ Bala ❖ Vriddha

10. वमन (Emesis)

शीते शीतप्रसेकार्तं श्लैष्मिकं कफकृद्विषम्।

वामयेद्वमनैस्तीक्ष्णैस्तथा मूर्च्छामदान्वितम्॥ (S.K.5/39)

Person who has symptoms of aggravation of Kapha, fainting and intoxication should be administered treatments which mitigate kapha and made to vomit using strong emetics.

According to A.H.: Various contexts of vamana-

1. Sthavara visha vega -(1st and 2nd)--
(A.H.U. 35/38)
2. Dooshi visha chikitsa.
3. Gara visha chikitsa. (A.H.U. 35/55)
4. Poisons of kapha in nature.
(A.H.U. 35/66)
5. Darvikara visha. (2nd vega, 4th vega, 5th
and 6th vega)
6. Mandali visha. (2, 3, 4, 5 vega)
7. Rajimantha visha. (2, 3, 4, 5 vegas)

11. विरेचन/Purgation therapy

Indications

कोष्ठदाहरुजाध्मान मूत्रसङ्गरुगन्वितम्।

विरेचयेच्छकृद्वायुसङ्गपित्तातुरं नरम्॥ (S. K. 5/40)

The person who has burning sensation and pain in the abdomen, flatulence and pain due to obstruction of urine, feces and flatus should be made to purge.

पैत्तिकं पैत्तिकैर्दृष्टमधो नाभेर्विषेशतः।

विषे पित्ताशयगते पाययेत विरेचनम्॥ (A.S. 42/48)

Virechana indicated when the person is in:

- ❖ Pitta constitution.
- ❖ Paitika snake bite occurred.
- ❖ Bite features occurred below umbilicus.
- ❖ Visha in pakvasaya asraya.

12. उपाधान चिकित्सा/ Kakapada

विषसंक्रमणार्तं मस्तके भेषजाधनम्। Chakrapani
काकपदमिति काकपदाकारं व्रणम्।

Upadhana chikitsa is a treatment in visha chikitsa wherein visha is taken out from mastaka, by applying medicines.

विषदूषितकफमार्गः स्रोतःसंरोधरुद्धवायुस्तु।

मृत इव श्वसेन्मर्त्यः स्यादसाध्यलिङ्गैर्विहीनश्च॥

चर्मकषायाः कल्कं बिल्वसमं मूर्ध्नि काकपदमस्य।

कृत्वा दद्यात् कटभीकटुकटफलप्रथमनं च॥

छागं गव्यं माहिषं वा मांसं कौक्कुटमेव च।

दद्यात् काकपदे तस्मिस्ततः संक्रमते विषम्॥

(Ch.Ch.23/65-67)

When the channels of circulation of kapha gets vitiated by poison – Causes obstruction in the channels of kapha – so movements of vayu gets obstructed – Patient breaths as if he going to die very soon – If the patient is free from asadhya lakshanas, signs and symptoms, incurability, then incision should be made on his hand, resembling the feet of crow (kakapada), and one vilwa of the paste of *charmakasha* (*saptala*) should be applied over.

Poison when localised in the urdha or head region should be cleared by samkramana procedure. The snake bites in the lower part of the body, an incision resembling a foot of a crow should be made in the head (allowing for bleeding), and then over it, or a piece

of muscle containing blood which is taken from animals such as crow, cock, peacock, goat, ox, buffalo or hen is placed over the incised area. If the bite happens in the upper part of the body, this kakapada chikitsa has to be done in the feet. The poison travels from the body into that muscle and protects the life of the bitten person.

According to Sushruta

ताडयेच्च सिरा क्षिप्रं तस्य शाखाललाटजाः ।
तास्वप्रसिच्यमानासु मूर्ध्नि शस्त्रेण शस्त्रवित् ॥
कुर्यात् काकपदाकारं व्रणमेवं स्रवन्ति ताः ।
सरक्तं चर्म मांसं वा निक्षिपेच्चास्य मूर्धनि ॥
चर्मवृक्षकषायं वा कल्कं वा कुशलो भिषक् ।

(Su.Ka.5/44-46)

The veins of limbs and forehead should be punctured quickly. If these do not bleed sufficiently, then a wound resembling shape of the crows foot should be made on the head with a sharp instrument. When blood comes out, a piece of either skin or muscles having blood in it should be placed on it, or either decoction or paste of charnavriksha may be placed by the intelligent physician.

Other contexts

Sthavara visha 7th Vega Rx

मूर्ध्नि काकपदं कृत्वा सासृग् वा पिशितम् क्षिपेत् ।

In the seventh vega of sthavara visha, one incision should be made on the head of the patient, and muscle or skin with blood is placed on that for absorption of poison.

Darvika chikitsa (7th vega)

कृत्वावगाढं शस्त्रेण मूर्ध्नि काकपदं ततः ।

मांसं स रुधिरं तस्य चर्म वा तत्र निक्षिपेत् ॥

Also, in darvikara visha, mandala visha and Rajila visha is treatment, like darvikara 7th vega.

13. हृदयावरण/Hridayavarana (Protection of Heart)

विषं कर्षति तीक्ष्णत्वाद् हृदयं तस्य गुप्तये ॥

पिबेदघृतं घृतक्षौद्रमगदं वा घृताप्लुतम् ।

हृदयावरणे चास्य श्लेष्मा हृद्युपचीयते ॥

(A. H. U. 36/54)

Because of penetrating action, poison weakens the heart in order to protect it. The patient should drink either ghee, mixture of ghee and honey or anti-poisonous recipe mixed with ghee. By this, *sleshma* gets increased in heart.

पश्चात्कर्म - वमन

प्रवृत्तगौरवोत्कलेशहल्लासं वामयेत्ततः ।

द्रवैः काञ्जिककौलत्थतैलमद्यादिवर्जितैः ॥

वमनैर्विषहृदिभश्च नैवं व्याप्नोति तद्वपुः ।

(A. H. U. 36/55-56)

When feeling of heaviness, salivation, nausea appear, he should be made to vomit using liquid emetics, avoiding kanjika (fermented gruel), koulatha (soup of horse gram), taila (oil), madya (wine), and things which are anti-poisonous. By this the poison does not spread all over the body.

14. अञ्जन/Application of Collyrium

शूनाक्षिकूटं निद्रार्तं विवर्णाविललोचनम् ।

विवर्णं चापि पश्यन्तमञ्जनैः समुपाचरेत् ॥ (S.K.5/41)

The person who has swelling around eyes, troubled sleep, eyes discoloured and dirty, and vision unclear, should be treated by applying collyriums.

Charaka says:

अञ्जनैः अक्ष्युपरोधे कर्तव्यं बस्त्रमूत्रपिष्टैस्तु ।

दारुव्योष हरिद्रा करवीर करञ्ज निम्ब सुरसैस्तु ॥

(Ch.Chi.23/69)

Application of collyrium using Daru, Vyosha, Haridra, Karaveera, Karanja, Nimba, and Surasa, triturated with bastamutra is used in akshi upoaroedha eye obstruction.

15. नस्य/Inhalation of medicines

शिरोगते विषे नस्तः कुर्यात् मूलानि बुद्धिमान् ।

बन्धुजीवस्य भार्ग्यस्य सुरसस्यासितस्य च ॥

(C. Ch. 23/181)

If poison is located in the siras (head), nasya should be done with bandhujeeva, bharngi and black surasa.

शिरोरुक् गौरवलस्य हनुस्तम्भ गलग्रहे।
शिरोविरेचयेत् क्षिप्रं मन्यास्तम्भे च दारुणे॥

(S.K. 5/42)

Nasya should be done when pain and heaviness of head, rigidity of lower jaw, obstruction in throat and severe catching pain in neck occurs.

16. धूम/Smoking therapy

न स्वेदयेत चादंशं धूमं वक्ष्यामि वृश्चिके।
शिखि कुक्कुटबर्हाणि सैन्धवं तैलसर्पिणी॥

(S.K. 8/45)

धूमो हन्ति प्रयुक्तस्तु शीघ्रं वृश्चिकजं विषम्।

(S.K. 8/72)

Dhooma is contra-indicated in case of visha except in the case of manda keeta visha which is vata kaphaja in nature and manda vrischika due to its predominance of vata. Fumigation (by smoke) of feathers of peacock and cock, saindhava, oil and ghee given to area of bite destroys the poison of scorpion quickly.

Dhoomagada

घृतयुक्ते नतकुष्ठे भुजगपतिशिरशिरीषपुष्पं च।
धूमागदः स्मृतोऽयं सर्वविषघ्नः श्वयथुहृच्च॥

(Ch.Chi. 23/99)

Fumigation of Nata, Kushta, Bhujagapatisira, Sireesha Pushpa.

नृकेशादिधूपनम्

नृकेशाः सर्षपाः पीता गुडो जीणश्च धूपनम्॥

विषदंशस्य सर्वस्य काश्यपः परमब्रवीत्।

(A.H.U. 37/23)

Nrikesa (human hairs) peetasarshapa and jeerna guda used for fumigation (of the bite) is best for patient bitten by all kinds of poisonous animals, according to Kashyapa.

17. लेह (Linctus)

दूषीविषारिमगदं लेहयेन्मधुनाप्लुतम्। (A. H. U. 35/38)

The treatment mentioned for dooshivisha is mainly sodhana after that lehana using dooshivishaari agada is indicated. If patient is unconscious, the agada can be given in linctus form.

गर विष - ताप्यादि लेह

शर्कराक्षौद्र संयुक्तं चूर्णं ताप्यसुवर्णयोः।

लेहः प्रशमयत्युग्रं सर्वयोगकृतं विषम्॥ (A.H.U. 35/56)

Licking of powder of tapya (swarna makshika) and swarna (gold) mixed with sugar and honey cures poison of all kinds and of combinations.

In amasaya visha & kanta gata visha

कपित्थमामं ससिताक्षौद्रं कण्ठगते विषे।

लिह्यादामाशयगते ताभ्यां चूर्णपलं नतात्॥

(Ch.Chi.23/184)

If visha is in the amasaya, then kapitha paste in raw state is given to the person along with honey, sugar and with one pala of nata. If it is in the kanta region, kapitha (raw) + sugar + honey has to be given.

18. औषध /Anti-toxic drugs

Oushadha means medicaments, but when it comes in the context of visha it means Agada.

Mode of Administration

1. With mantra
2. Without mantra

Examples		
a.	Kashayam	Sindhuvaaradhi kashayam
b.	Gulika	Mrita sanjeevani agada
c.	Taila	Parantyaadi tailam
d.	Arishta	Sirisharishta
e.	Lehya	Dushivishari agada
f.	Ghrita	Amrita ghrita, ajeya ghrita
g.	Peya	Kosatakyadi yavagu
h.	Single drugs	Ekasaragana

Therapies		
a.	Nasya	Sita, Maricha in Sirisha pushpa swarasa for 3 days

Therapies		
b.	Anjana	Garudanjana
c.	Dhoopa	Dhoomagada Dhooma Varti
d	Taila	Paranthayadhi
e	Lepa	Nagaradi Lepa Vilwadi Agada lepa
f	Application of dundubhi (drum), thorana (Decors) pataka (flags) etc.	Mahasugandhi Agada Kshara Agada

19. प्रशमन/Suppressive drugs/dosha alleviating

- ❖ Palliative treatment
- ❖ Does not expel doshas
- ❖ Can be given in *vishopadrava* condition.

पेयादि उपशमन शब्देन गृह्यते । - चक्रपाणि

Upasamana: Peyadi

E.g.:

- ❖ Koshatakyodhi Yavagu
- ❖ During Elakki chikitsa (specific treatment for rabies), Peya administration is mentioned.

20. प्रतिसारण

(Rubbing with Anti-poisonous powders)

पिप्पलीनागरक्षारं नवनीतेन मूर्च्छितम् ।

प्रवृद्धे कण्ठगे दद्याच्छ्लेष्मणी प्रतिसारणम् ॥

(A. S. U. 42/36)

If the greatly increased Kapha has accumulated in the throat, ashes of pippali and nagara mixed with butter should be applied.

21. प्रतिविष (Poison to counteract poison)

विषे विषान्तर प्रयोग – प्रतिविष (Chakrapani)

Usage of visha to counteract the effect of poison.

विषे प्रतिविषं योज्यं मन्त्रतन्त्रैरसिध्यति ।

अतीते पञ्चमे वेगे सप्तमस्यानतिक्रमे ॥ (A.S.U. 48/2)

When the effect of poison does not subside by curative hymns and drugs, after the lapse

of 5th Vega before the lapse of 7th Vega, then *Prativisha* has to be administered.

स्थावर विष – श्लेष्म तुल्य गुणम् – स्थिरम् ऊर्ध्वगामि
जङ्गम विष – पित्त तुल्य युक्तम् – अधोगामि च जङ्गमं

Two kinds of poison possessing opposite qualities, when put together destroys each other. That is why a person bitten by snake should be given poisonous roots in the form of internal and external application.

युज्यान्मूलविषं तस्माद्दृष्टानां पानलेपयोः ।

The person who has consumed poison (vegetable) should be bitten by a snake by a clever physician.

न विषप्रतिमं किञ्चिन्निर्विषीकरणं विषे ।

Nothing equal to visha to neutralize visha.

Dose of Prativisha

For Sthavara visha: It has to be administered in the dose of

- ❖ 2 – Yava - Avara Mathra
- ❖ 6 – Yava - Madhyama Mathra
- ❖ 8 – Yava - Theekshna Mathra

Contraindication

नैव तु असृक्स्थे:- When poison is localised in blood, no *prativisha* is administered.

पाने तु लूता दष्टस्य नेष्यते:- Oral administration is contraindicated in *loota visha*.

Merits and Demerits

Counter poison acts like nectar when applied to wounds of persons who are poisoned.

Paschat Karma

After administration of *teekshna prativisha*, patient should be made to drink *Ghritha* processed with *Bhargi*, *Dadhi*, *Dhoomotha*, *Saariva*. Or *Agaara dhooma manjishta yashti* or *Arjuna twakchurna madhu*, and *sarpis*.

22. संज्ञासंस्थापनं**(Medicines for Restoration of Consciousness)**

Samjasamsthapanam should be done when the Vegas crosses 5th Vega before reaching 7th Vega that is in the 6th vega.

गोपित्तयुता रजनि मञ्जिष्ठा मरिच पिप्पलि पानम्।

(C. Ch. 23/49)

It should be done in

- ❖ 6th Vega
- ❖ Drink potions prepared of Rajani, Manjishta, Maricha, and Pippali, added with Gopitta.

23. लेप (Application of paste or ointment)

As a major treatment

घर्षणमति प्रवृत्ते वटादिभिः शीतलैर्लेपः।

(Ch. Chi. 23/41)

If there is excessive bleeding occurs in bloodletting therapies, cooling paste of vata (ksheerivrikshas) etc. should be applied.

Other contexts:

A. Keeta visha

क्षीरिवृक्षत्वगालेपः शुद्धे कीटविषापहः।

मुक्तालेपो वर शोथदाहतोदज्वरापहम्॥

(Ch. Chi. 23/199)

Application of क्षीरिवृक्षलेप after sodhana. (A. H. U. 37/26)

Muktaalepa for sophia, toda, daha and jwara can be application.

B. Akhu visha

Agaradhoomadhi lepa

अगार धूम मञ्जिष्ठारजनि लवणोत्तमै लेपो जयत्याखुविषम्। (A. H. U. 38/18)

24. मृतसंजीवनं/Revival of Life

मृतस्य अमृत इव संजीवनकरमौषधम् इति। – Done in 8th vega for persons who are about to die.

Oushadha helps in the revival of a person.

शिखिपित्तार्थयुतं स्यात् पलाशबीजमगदो मृतेषु वरः।

वार्ताकुफाणितागारधूमगोपित्तनिम्बं वा॥

गोपित्तयुतैर्गुटिकाः सुरसाग्रन्थिद्विरजनीमधुककुष्ठैः।

शस्ताऽमृतेन तुल्या शिरीषपुष्पकाकाण्डकरसैर्वा॥

काकाण्डसुरसगवाक्षी पुनर्नवावायसीशिरीषफलैः।

उद्बन्धविषजलमृते लेपौपधिनस्यपानानि॥

(Ch. Chi. 23/52-53)

If the patient appears to be dead on account of poisoning, he should be given the powder of seed of palasa and ½ quantity of Sikipitta.

Or vartaakoo, phanita, aagaara dhooma, gopitha, and nimba can be used in the form of powder.

2.3 General Principles of Management of Poisoning

Poisoning is an emergency situation where immediate resuscitative measures have to be adopted and also removal of the poison from the body both absorbed and unabsorbed has to be done to save the life of the patient.

Immediate measures/resuscitative measures in comatose patients should be adopted to stabilise.

1. Airway maintenance-endotracheal intubation is needed
2. If needed oxygen supply have to be done
3. Circulation should be maintained through iv fluids and drugs.
4. CNS depression should be corrected by drugs and supportive measures.

A. Removal of the poison from Body

If poison inhaled as a gas

- ❖ Patient should be removed from fresh air.
- ❖ Artificial respiration should be done.
- ❖ Oxygen therapy (6-8 L/Minute) should be given.
- ❖ The air passage should be kept clean from mucus by postural drainage or by aspiration.

For injected poisons

- ❖ Tight ligature should be applied immediately above the wound which must be

loosened for one minute after every 10 minutes to prevent gangrene.

- ❖ Wound should be excised
- ❖ Poison sucked out
- ❖ Poison neutralises with suitable chemical substance
- ❖ Local vasoconstriction can be done with injection of adrenaline
- ❖ Immersion of extremities in water at 10°C slows capillary blood flow and limit the absorption.

Contact Poisons

- ❖ In case of contact poisons, contaminated clothes, jewelley, contact lenses of the patient should be removed immediately.
- ❖ If poison is applied to the skin or wound or inserted into vagina, rectum or urinary bladder, it should be removed by wash those area with running water for 30 minutes and neutralise those poison with antidote chemical substances.
- ❖ Eyes should be irrigated with normal saline for at least 15 minutes.

Ingested Poisons: Gastric lavage

It is indicated within 3 hrs after ingestion. It is done as early as possible. For this purpose, stomach tube/Ewald tube or Boa tube is utilised.

Description of stomach tube

Material: Flexible red rubber tube

Length: 1.5m

Diameter: 1m

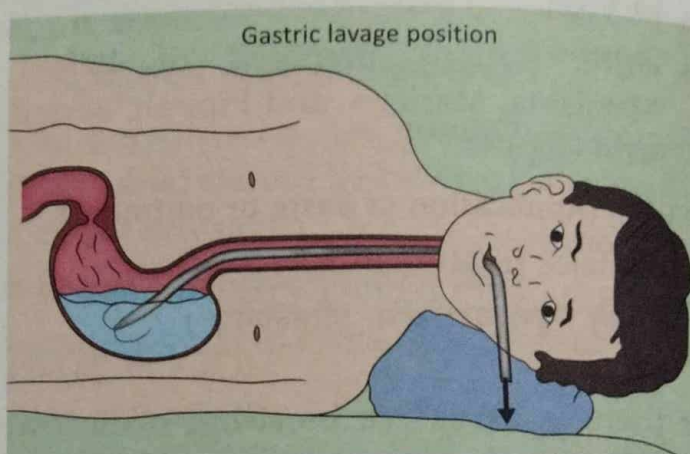
Upper end: Funnel

Lower end: Blunt and round with one or two lateral openings.

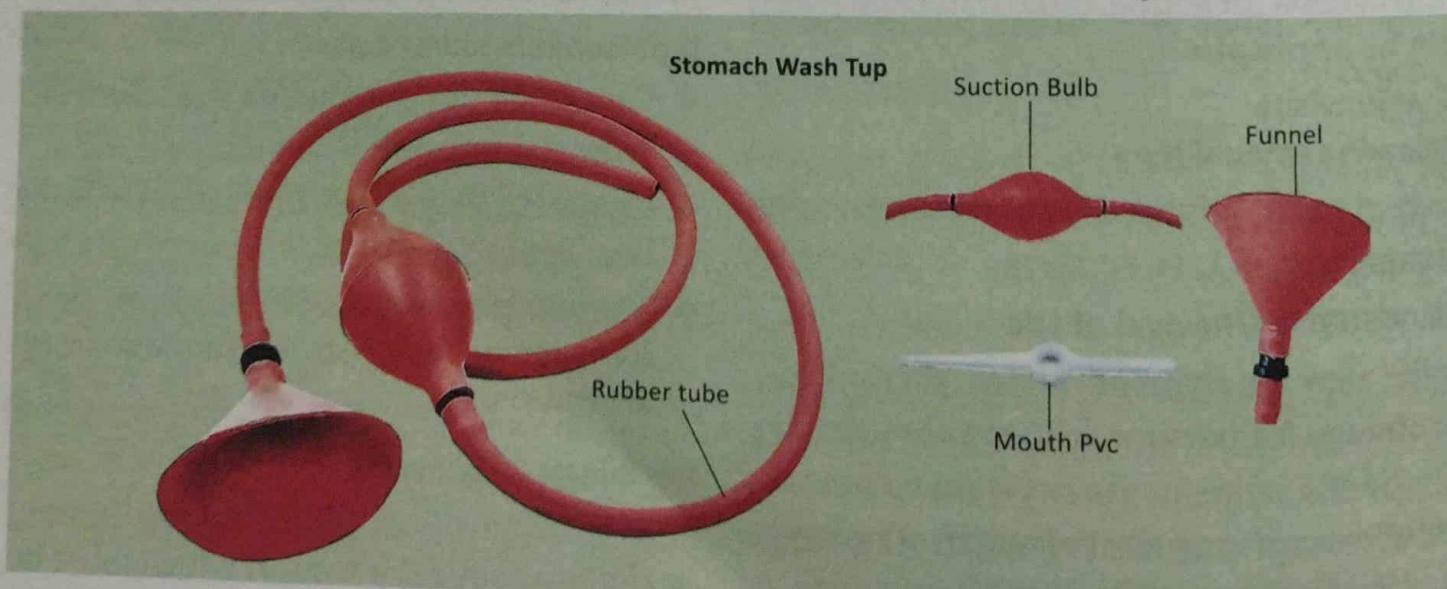
Midpoint: Suction bulb

Mark: At 50cm from lower end

Procedure



Patient should lay in the left lateral position. The tube is inserted **up to 50 cm** mark on it. Head should be at a lower level supported by an assistant. **Mouth gag** is used to prevent the biting of the tube. Wooden mouth gag with a hole in its center to allow the tube to pass through should be used. Introduce the tube very carefully to keep it a way from the trachea. About **250 ml of warm water** should be poured through the funnel. When



the funnel is empty lower it and the suction bulb is pressed to expel the contents from the stomach. The first wash should be preserved for chemical analysis, appropriate antidote can be added to the water, used for stomach wash, depending on the case.

In children, Rhyle tube is used to aspirate the contents.

Contraindications

- ❖ **Convulsions**
- ❖ **Corrosive poisoning:** In poisoning corrosive acids and alkalies except phenol, perforation may occur due to stomach wash tube while inserting.
- ❖ **Unconscious patient**
- ❖ **Volatile poisons:** Kerosene, petrol, etc. are contraindicated due to the risk of aspirational pneumonia.
- ❖ **Esophageal varices**
- ❖ **Hypothermia**

B. Administration of Emetics

Emetics

- ❖ It should be done in case of difficulty in using stomach tube.
- ❖ Vomiting can be produced only if the medullary centre is still responsive.
- ❖ Due to the danger of aspiration of gastric contents.
- ❖ Vomiting should only be induced when a conscious patient is lying on his side with the head dependent.

Common emetic used is **Ipecacuanha** powder and syrup can be used as a safe emetic. Household emetics such as mustard powder, common salt, etc. are not recommended.

C. Administration of Antidotes

Antidotes

Antidotes are the substances which contract or neutralise the effect of poisons.

Mode of action of antidotes:

1. Inert complex formation

E.g.: Chelating agents for heavy metals
Dicobaltdetate for cyanide.

2. Accelerated detoxification

E.g.: Thiosulfate for cyanide.

3. Reduced toxic conversation

E.g.: Ethanol for methanol.

4. Receptor site blockage

E.g.: Naloxone for opiates
Atropine for organophosphates

5. Toxic effect by pass

100% oxygen therapy in cyanide poisoning.

Classification of Antidotes

1. Physical/mechanical Antidotes

They neutralize poison by mechanical action or prevent their absorption.

Activated charcoal

- ❖ It is fine black, odourless, tasteless and powder.
- ❖ It can be used by mixing with water to form soup like slurry.
- ❖ Barbiturates, atropine, benzodiazepines, quinine, and strychnine are well absorbed by activated charcoal.
- ❖ It is not useful in poisoning with corrosives, heavy metals, cyanide, hydrocarbon and alcohol

Initial dose

- ❖ 15-30 grams in children
- ❖ 60-100 grams in Adults

Demulcents

These substances form a protective coating on the gastric mucosa membrane and do not permit the poison to cause any damage.

Examples: Milk, starch, egg white, mineral oils and milk of magnesia.

Bulky foods

These act as a mechanical antidote to glass powder, thus prevents damage by sharp glass particles.

2. Chemical antidotes

They counteract the action of poison by forming harmless or insoluble compounds or by oxidising poison when brought in to contact with them.

Examples:

- ❖ Common salt decomposes silver nitrate by direct chemical action forms insoluble silver chloride.
- ❖ Albumen precipitates mercuric chloride
- ❖ Dialyzed iron neutralizes – Arsenic
- ❖ Copper sulphate used to precipitate phosphorus.
- ❖ Potassium permanganate has oxidising properties 1:5000 solution of KMnO_4 is used to neutralise opium and its derivatives, strychnine, phosphorus, HCN acid, atropine etc.
- ❖ The very famous universal antidote which consists of activated charcoal (2 parts), magnesium sulphate (1 part) and tannic acid (1 part) is not used now a days because it is found that tannic acid interferes with the adsorption capacity of activated charcoal.

3. Physiological or pharmacological Antidotes

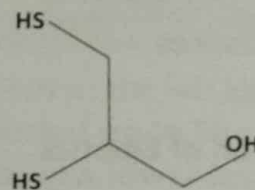
- ❖ They act on the tissues of the body, and produce symptoms, exactly opposite to those caused by the poison.
- ❖ They are used after some of the poison is absorbed into the circulation.
- ❖ They physiologically antagonise the effect of the poison in the body. E.g. atropine used in organophosphorus poisoning and diazepam in strychnine.

4. Specific antidotes

These are the substances which inactivate the poison by directly reacting with the poison in the blood tissues or by inhibiting the action of the poison at the receptors sites. E.g: chelating agents in metallic poisoning, oximes in organo phosphates poisoning.

A. Chelating Agents

- ❖ Useful in heavy metal poisoning.
- ❖ Due to greater affinity towards heavy metals.
- ❖ They form complexes with heavy metals, which are more water soluble than metal itself, resulting in higher renal excretion of the complex and inactivation of heavy metals.
- ❖ B.A.L– (British Anti-lewisite / Dimercaprol)



Used as a chelating agent in arsenic, lead, bismuth, copper, mercury, gold, thallium and antimony. Dimercaprol has two unsaturated sulphydryl groups which have high affinity towards heavymetals which combine with heavymetal and thus prevent union of arsenic with the SH (sulphydril) group of the respiratory enzyme system which is rapidly affected with this heavymetals.

- ❖ **Dose:** 3-4 mg/kg is given in severe poisoning in every 4 hrs, for the first two days and twice daily for the next 10 days as IM injections.
- ❖ **Route:** IM not IV (as it causes a chance of occurrence of fat embolism).
- ❖ **Side effects:** These are anorexia, nausea, vomiting, restlessness, salivation, lacrimation, body ache, rise in temperature, fall in BP and burning pain in the eyes.

B. EDTA (Ethylene Diamine Tetra acetic acid)

Uses: It is usually used in lead, mercury, cobalt, manganese and cadmium poisoning.

Dose: 25-35mg/kg of body weight, it is given twice in a day for five days.

Side effects: These included anorexia, nausea, vomiting, hypersensitivity, fall in BP and vertigo.

C. Penicillamine (Cuprimine)

It is a hydrolysis product of penicillin. It has stable SH group. It is used as an antidote in copper, zinc, lead, mercury, etc. poisoning.

Dose: It is given orally in a dose of 30mg/kg and up to 2gm/per day for seven days.

D. Desferrioxamine

It is a water soluble chelating agent having high affinity towards iron. It has trivalent ion as a chelate and very useful in iron poisoning. It is given 8-12 gm orally daily in divided doses to prevent absorption from stomach.

E. Forced alkaline diuresis

Forced alkaline diuresis is the administration of diuretic agents and isotonic saline with sodium bicarbonate intravenously which increases glomerular filtration rate and urine flow. This helps to achieve a urinary pH of 7.5-9 and promotes the excretion of poison through urine.

Examples: Salicylates, barbiturate poisoning, and aspirin poisoning.

F. Peritoneal dialysis

Extracorporeal removal techniques such as hemodialysis, peritoneal dialysis and hemo-perfusion are commonly used in the removal of poison from the blood which has been already absorbed.

Alcohols, long acting barbiturates, chloral hydrate, lithium salicylates and bromide are examples of chemicals generally removed by peritoneal dialysis.

G. Hemodialysis

This is useful in poisoning with methanol, ethanol, ethylene glycol, chloral hydrate and salicylates.

This is not used in poisoning of organophosphates, kerosene oil, digitalis, copper sulphate, etc.

H. Hemoperfusion

Toxins are removed by passage of anti-coagulated blood through a device, usually a column that contains absorbent particles. This is used in poisoning of salicylates and paraquat.

I. Nursing and psychiatric care

Mental status of the patient has to be monitored.

It is very important to maintain normal electrolyte balance, and to maintain the pulse, blood pressure and respiration.

Coma Cocktail

It is a combination of medicines which are given to comatose patients in case of unknown poisoning. This combination includes:

1. Dextrose - 100ml 50% solution
2. Thiamine (Vit. B1) - 100mg
3. Naloxone - 2mg

These combination should be given intravenously, with the assumption that these persons are affected with alcohol, opium poisoning or any other hypoglycemic drugs.

2.4 Duties of Medical Practitioner In Case of Suspected Poisoning

Duties medical practitioner are discussed below

Medical duties

- ❖ Care and treatment of the patient.
- ❖ Medical duties include emergency management of poisoning.

Legal duties

- ❖ Assist the police to determine the manner of death.
- ❖ Collect the evidences regarding the poisoning.

Medico-Legal Duties

1. Note the preliminary particulars of the patient including age, sex, address, date, time and identification marks.
2. In case of suspected homicidal poisoning, doctor must confirm his suspicion before expressing an opinion :
 - Take history of route of exposure.
 - Quantity of poison consumed.
 - Time elapsed after poisoning.
 - Collect vomiting, urine for analysis.
 - Observe and record the symptoms.
3. If private practitioner is convinced that a patient is suffering from homicidal poisoning, he/she is bound under the law **S.39 of CrPC** to inform the police or magistrate. CrPC 39 : States that, it is mandatory for individuals to report the commission of certain offences to the police/authority. Non-compliance is punishable under **S.176 of IPC**.
4. Any suspected article of food, excreta and stomach wash samples should be preserved. Any recent stains on bed clothes and furniture should be preserved if possible. Non-compliance is punishable under **S.201 of IPC**.

5. If doctor is sure that patient is suffering from suicidal poisoning, he is bound to inform police (**S.309 of IPC**). As per new Mental Health Act (2017) IPC 309 has been decriminalized, so attempting suicide is not considered as a criminal offence any more. But doctors still have a duty to inform the Police if they believe a patient has attempted suicide or has been harmed by someone else. This is to ensure the patient's safety, provide appropriate medical care and to investigate any underlying risks or issues.
6. If the doctor is summoned by the investigating officer, he is bound to give all information, regarding the case under **S.175 of CrPC**.
7. If he conceals any information, he/she is liable to be prosecuted under **S.202 of IPC** and if he gives false information he will be charged under **S.177 of IPC**.
8. A govt. MO is required to report to police all cases of suspected poisoning, whether accidental, suicidal or homicidal attended in hospital.
9. If condition of the patient is serious he must arrange to record dying declaration.
10. If the patient dies, he must not issue death certificate, but should inform police.
11. In case of food poisoning, public health authorities must be notified.

Summary**Duties of a doctor in case of poisoning**

- ❖ Medical duties: Diagnosis and management of poisoning
- ❖ Legal duties

Diagnosis of poisoning

1. **By taking clinical history:** questions asked about symptoms, amount ingested, and time since ingestion, vomiting etc.

2. Clinical signs: Hypertension or hypotension, tachycardia or bradycardia, hyperthermia or hypothermia, pupillary constriction or pupillary dilatation, poisons with characteristic odour, frothing, CNS symptoms, peripheral neuropathy etc.

3. Lab investigations: Chemical analysis of sample preserved, gastric lavage contents, vomitus, blood, urine and saliva, breath, hair, ECG, EEG, X-ray

Chaturvimsasati upakrama

These are the 24 upakramas are mentioned for visha by Acharya Charaka in chikitsa sthana 24th chapter.

1. Mantra	Recitation of mantra
2. Arishta	Tying ligature
3. Utkartana	Excision of bite site
4. Nishpeedana	Squeezing of blood from bite site
5. Chooshana	Sucking out blood from bite site
6. Agni	Cauterization
7. Parisheka	Irrigation
8. Avagaaha	Immersion of bite site in medicated water
9. Rakta mokshana	Blood letting
10. Vamana	Emesis
11. Vireka	Purgation
12. Upaadhana	Application of medicines after incision of scalp/sole
13. Hridayaa-varanam	Protection of heart

14. Anjana	Collyrium
15. Nasya	Nasal inhalation
16. Dhooma	Fumigation
17. Leha	Drugs in the form of linctus
18. Oushadha	Anti-toxic drugs
19. Prasamana	Conservative treatments
20. Pratisarana	Rubbing with anti-poisonous powders
21. Prativisha	Administration of poisons to counteract poisons
22. Samjasthapana	Restoration of consciousness
23. Lepa	External application of medicaments
24. Mruta sanjeevana	Revival of apparently dead persons

General principles of management of poisoning

Treatment of poisoning: Two important things to be noticed mainly:

- ❖ Keep concentration of poison as low as possible by preventing absorption and increasing elimination.
- ❖ Counteract toxicological effects at effector site, if possible.

Management of poisoning–

- ❖ Stabilization of the patient.
- ❖ Diagnosis of poisoning.
- ❖ Prevention of further toxin absorption.
- ❖ Enhancement of toxin elimination.
- ❖ Administration of antidote.
- ❖ Supportive care and follow up.

Important Questions

MCQ

1. The reference of chaturvimshati upakrama is from

- a. Charaka Chikitsasthana
- b. Sushruta Kalpasthana
- c. Madhava Nidana

d. Ashatanga Hridaya

2. Parama kriya in visha chikitsa

- a. Vamana
- b. Siravyadha
- c. Nasya
- d. Kashayapaana

3. Bitter almond like smell occurs in which poisoning

- a. Carbon monoxide poisoning
- b. Cyanide poisoning
- c. Organophosphates
- d. Aspirin poisoning

4. Blisters in skin are seen in case of

- a. Carbon monoxide poisoning
- b. Corrosive poisoning
- c. Organophosphorus poisoning

d. Both a & c

5. Medicines placing on the head is known as

- a. Hridayavarana
- b. Mrutasanjeevanam
- c. Samjasamsthapanam
- d. Upadhana chikitsa

Answer key

1. a

2. b

3. b

4. d

5. d

Learning Objectives

- Describe the diagnosis of poison in living and dead.
- Enumerate and describe Chaturvimsati upakramas.
- Describe general principles of management of poisons.
- Describe the duties of a doctor in case of suspected poisoning.

Important SAQ

- Explain diagnosis of poisoning.
- Briefly describe hridayavarana.
- What is upadhana chikitsa?
- What is Coma cocktail?
- Explain BAL.

Important LAQ

- Explain chaturvimsati upakrama.
- Discuss general principles of management of poisoning.
- Explain the removal of unabsorbed poisoning and its antidotes.
- Explain duties of medical practitioner in case of poisoning.
- Explain Hridayavarana.

• • •

Vishakta Ahara and Pariksha and Viruddha Ahara

3.1 Sources of exposure of Visha with Contemporary relevance

Food contamination can occur from multiple sources including natural as well as artificial. The health implications can happen from a small gastroenteritis to fatal cases like hepatic, renal and neurological diseases.

Classifications of food contamination

1. Physical contamination
 2. Chemical contamination
 3. Biological contamination
 4. Allergenic contamination
- ❖ **Physical contamination:** Physical contaminants include hair, glass or metal, pests, jewellery, dirt and fingernails dirt.
 - ❖ **Biological contamination:** This includes various harmful microorganisms in the food such as bacterias, viruses, yeasts, moulds and parasites.

Examples of biological hazards include salmonella, E coli, clostridium botulinum and clostridium perfringens. Food poisoning occurs when disease causing microorganisms spread to whole food and multiply and that food is then consumed. Some foods provide good temperature and environment to the microorganisms where they multiply fast when the affected food is consumed. It causes various ailments.

- ❖ **Chemical contamination:** Unwashed fruits and vegetables contain various pesticides and fungicides which cause various adverse health effects when ingested.
- ❖ **Allergens:** Cereals especially wheat contain gluten causing various coeliac diseases are good examples of food allergens. Crustaceans, eggs and mustards also cause various types of allergies to persons.

3.2 Vishakta Ahara Pariksha

नृपभक्ताद्बलिं न्यस्तं सविषं भक्षयन्ति ये ।
तत्रैव ते विनश्यन्ति माक्षिकावायसादयः ॥
हुतभुक् तेन चान्नेन भृशं चटचटायते ।
मयूरकण्ठप्रतिमो जायते चापि दुस्सहः ॥
भिन्नार्चिस्तीधूमश्च नाचिराच्चोपशाम्यति ।
चकोरस्याक्षिवैराग्यं जायते क्षिप्रमेव तु ।
दृष्ट्वाऽन्नं विषसंसृष्टं ग्रीयन्ते जीवजीवकाः ॥
कोकिलः स्वरवैकृत्यं क्रौञ्चस्तु मदमृच्छति ।
हृष्येन्मयूर उद्विग्नः क्रोशतः शुकसारिके ॥
हंसः क्ष्वेडति चात्यर्थं भृङ्गराजस्तुकूजति ।
पृषतो विसृजत्यश्रुं विष्टां मुञ्जति मर्कटः ॥ (S.K.1/28-33)

Panchaboutika visha pariksha

1. Shabda pariksha

हुतभुक् तेन चान्नेन भृशं चटचटायते । (S.K.1/29)

When poisoned food is put on fire, it burns with cracking sound.

2. Sparsa pariksha

पाणिप्राप्तं पाणि दाहं नखशातं करोति च। (S.K.1/37)

When poisoned food comes in contact with hand, it produces burning sensation and fall of nails.

3. Roopa pariksha

मयूर कण्ठ प्रतिमो जायते चापि दुसहः। (S.K.1/29)

Different coloured flames appear like peacock neck, when poisoned food put on fire.

4. Rasa pariksha

नृपभक्ताद्बलिं न्यस्तं सविषं भक्षयन्ति ये।

तत्रैव ते विनश्यन्ति माक्षिकावायसादयः॥ (S.K.1/28)

Animals like flies and crows, which eat poisoned food die immediately.

5. Gandha pariksha

भिन्नार्चिस्तीक्ष्ण धूमश्च नचिराच्चोपशाम्यति।

(S.K.1/30)

Poisoned fumes do not end up but continuously are emitted when poisoned food is put on fire.

Testing vishanna on Animals

Animal category	Change
Jeevajeevaka	Marana/death
Kokila	Swara vaikrityam /sound becomes abnormal
Krouncha	Intoxicated or agitated
Mayoora –udwigna	Peacock which is cheerful or agitated
Suka- krosata	Parrots and mynahs cries due to fear
Hamsa –shveda	Swan makes more sound
Bhringaraja –koojati	The bringaaja birds hoots
Prushata –asru visarjati	Spotted deer sheds tear
Markata –vishtaam munjati	Monkey defecates

3.3 Adulteration and test for its detection

Food adulteration means any addition or deletion of any substance to or from the

food, affective natural composition and quantity its.

It is of two types: Intentional and unintentional.

Intentional adulteration is the removal or adding any substances purposefully to change its natural qualities to get economic or technical benefits. Unintentional adulteration usually occurs due to ignorance, carelessness or lack of facilities for maintaining food quality.

Food adulteration

Food adulteration happened if–

- ❖ A substance added depreciates or injuriously affects it.
- ❖ Cheaper or inferior substances are used for substituting any part of the food.
- ❖ Colour which is added to make the food to look good reduces its quality.
- ❖ For whatever reasons the quality of food is below the standard.

Some commonly used adulterants and health effects

- ❖ Urea, soapy materials, or other harmful materials used in milk or milk products.
- ❖ Injecting various growth hormones in vegetables.
- ❖ Steroid injection in chicken for fast growth in short span of time.
- ❖ Fruits ripened by using harmful chemicals.
- ❖ Colouring matters in food materials.

Health hazards due to adulteration

Adulteration of food in humans causes various health issues in humans. Some of the health hazards include stomach ache, body ache, anemia, paralysis, tumor, pathological lesions in vital organs, abnormalities in eyes, heart diseases, kidney diseases, skin diseases, asthma and other chronic diseases.

Common food items, adulteration methods and health hazards

Food	Commonly used Adulterants	Health issues
Milk	Starch, milk powder, urea	Cancer, acute renal failure
Tur dal, turmeric powder, mixed spices, saffron	Metanil yellow-colour agent	Tumor and cancer.
Ghee	Artificial ghee essence	Cancer and acute renal failure
Sugar and salt	Chalk powder, white sand	Stomach disorder.
Tea powder	Used tea leaves, dye or artificial colour.	Cancer tetanus
Chilli powder	Sudan red, red brick powder, grit, sand, dirt, saw dust, artificial colours.	Stomach disorder and cancer (sudan dye is carcinogenic).
Mustard seeds, vegetable oils	Argemone seeds, argemone oil	Epidemic dropsy
Honey	Jaggery, sugar, corn syrup.	Obesity, diabetes, eyes and nerve damage.
Asafoetida	Soap stones, earthy matters.	
Cumin seed	Grass seeds which is coloured.	

Some common food adulteration detection tests

Food item	Adulterant	Detection
Milk	Starch	Add few drops of iodine solution –formation of blue colour indicates starch.
Milk	Urea	Take a tea spoon of milk in test tube, add ½ teaspoon of soybean or pigeon pea powder, mix the contents thoroughly, after Five minutes dip a red litmus paper in it, remove the paper after half a minute, a change in colour from red to blue indicates the presence of urea in milk.
Milk	Synthetic milk	Synthetic milk has a bitter after taste, gives a soapy feeling on rubbing between the fingers and turns yellowish on heating.
Milk	Detergent	Shake 5-10ml of sample with equal amount of water, formation of foam indicates the presence of detergent.
Sweet curd	Vanaspati	Take a table spoon of curd in a test tube, add 10 drops of hydrochloric acid, mix the contents, after five minutes if red colour is seen it indicates presence of vanaspati.
Ghee	Vanaspati or Margarine	Take 1 table spoon of melted ghee, with equal quantity of HCl, and add pinch of sugar, shake it well and leave it for five minutes, appearance of crimson red colour means presence of vanaspati or margarine.
Edible oil	Prohibited colour	Take 5ml of sample in a test tube and add 5ml of concentrated HCl, shake gently, let it stand for five minutes, colour will separate in the upper layer of the solution.
Coconut oil	Other oils	Place a small bottle oil in the refrigerator, coconut oil solidifies leaving the adulterant as a separate layer.
Sugar	Chalk powder	Dissolve 10gm of sugar sample in a glass of water, allow settling, chalk will settle down at the bottom.

Food item	Adulterant	Detection
Honey	Sugar solution, jaggery	A cotton wick dipped in pure honey when lighted with a match stick burns and shows the purity of honey. If adulterated, the presence of water does not allow it to burn, if it does it will produce a cracking sound.
Jaggery	Washing soda	Add a few drops of solution of HCl, effervescence shows the presence of washing soda.
Maida /rice	Boric acid	Take a small amount of sample in a test tube, add some water and shake. Add a few drops of HCl, dip a turmeric paper strip, if it turns red.
Pulses	Lead chromate	Shake 5 gm of pulse, with 5 ml of water, and add a few drops of HCl. Pink colour indicated lead chromate.
Black pepper	Papaya seeds	Papaya seed can be identified as it is shrunken, oval in shape, and greenish brown or brownish black in colour.
Chilli powder	Brick powder, Talc powder	To a little quantity of chilli powder, add a small amount of conc. HCl and mix to the consistency of the paste (missions) dip the rear end of the match stick into the paste, and hold over the flame, brick red colour will appear due to the presence of calcium salts in brick powder.

Related Law

IPC 272: Adulteration of food or drink intended for sale.

Whoever adulterates any articles of food or drinks, so as to make such article noxious as food or drink intending to sell such article as food or drink shall be punished with imprisonment either description for a term which may extend to six months or with fine or which may extend to 1000 rupees or both.

3.4 Techniques used for detection of Poisons

Modern Toxicological Techniques For Detection of Poison are described below.

Analytical Toxicology

Analytical toxicology is the branch of toxicology that involves the identification, quantification and analysis of toxic substances, including drugs, chemicals and poisons, in biological and environmental samples. It uses various scientific techniques, such as chromatography, spectrometry, and immunoassays, to detect and measure

these substances, aiding in the diagnosis of poisoning, forensic investigations, drug monitoring and ensuring public safety by assessing exposure to hazardous materials.

Chromatography

It is a separation technique utilising partitioning characteristics of different chemical substances in different media. The particular substances in media move a constant distance in a given time. The ratio of the distance travelled by the solvent is known as R_f value of the substance for that particular system. Identification of the substance then rests on comparing the disclosed R_F values mentioned in the reference table. This is used in the analysis of organic substances. Different types of chromatographic techniques:

- Thin layer chromatography
- Column chromatography
- High Performance liquid chromatography
- Gas chromatography.

Spectrometry

The principle involved in spectrometry is that there should be no differences between the intensities and reference because at all times, it is the measurement of the interactions between light and matter and the reactions and measurement of radiation intensity and wavelength. In other words, spectrometry is a method of studying and measuring a specific spectrum and it's widely used for the spectroscopic analysis of sample materials.

Mass spectrometry

It detects a substance in a minute quantity. The testing material in trace amount is placed inside a vacuum chamber and is then collided by high energy electrons. This causes loss of electrons from the molecules of testing material which get positively charged. This molecule breaks down into numerous fragments which are then separated according to their mass, by passing through electromagnetic fields. This is applicable only in case of testing some pure material.

GCMS (Gas chromatography – Mass Spectrometry)

GCMS is an analytical technique that combines the features of gas chromatography and mass spectrometry to identify different substances within a test sample.

In this method

GC: Separates the drugs/components

MS: Positively identifies them

This method is 100% specific. It separates the biological components and sensitively detect toxic agents in a complex biochemicals matrix. By means of chemical ionization and single or multiple ion monitoring techniques, picro-gram quantitative analysis is possible.

Immuno assay methods

1. Radio immuno assay
2. Flouroscent immuno assay
3. Enzyme mediated immuno assay technique (EMIT)

RIA

It is a very sensitive and less specific technique for quantitative analysis. Mixing known quantities of drug specific antibody, and known amount of radioactive, labelled drug to the specimen to be analysed causes a precipitation reaction. It detects very low concentration of drugs such as cannabis, digoxin, LSD, paraquat, etc.

EMIT

It is very useful for quantitative analysis of many popular drugs and substances of abuse. It is specific but less sensitive than RIA and is much easier to use and produce results very rapidly. This is done by enzyme activity and correlates with drug concentration, in the specimen as measured by absorbance change resulting from enzyme catalytic action on substrate.

NIA (Neutron activation analysis)

It is based on the principle that many substances become radio-active when exposed to bombardment by neutrons, which are highly specific of the elements contributing to it. This is a highly sophisticated and experience method compared to other conventional methods.

Chemical test for Detection of poison Test

- ❖ **Presumptive:** Less accurate
- ❖ **Confirmatory test:** Helps in identification of substance and query.

Test Name	Procedure	Result
Marquis reagent test	Place a drop of marquis reagent (3 ml con. H_2SO_4 + 3 ml of formalin) on the suspected scene reduce or add few drops to stomach contents	A purple colouration which gradually turns into violet and finally to blue colour indicates the presence of opium and it's derivate.
Fujiwara test	Dilute 1ml of sample with 2ml NaOH solution	A blue colour indicates the presence of cyanide
Reinsch test	—	Copper black – Antimony Dull black – Arsenic Shiny black – Bismuth Silver colour – Mercury
Trinders test	Add trinder's reagent + 2ml urine and mix for five minutes.	A violet colour indicates salicylates.
Duquenois levine test	Sample + 2ml of duquenois reagent + 2ml concentrated HCl (10mts), then add chloroform.	The violet coloured layer gives the positive indication of presence of cannabis.
Gerrard's test	1-2ml of 2% $HgCl_2$ solution in 50% alcohol is added to a portion of the extract. A red colour develops immediately.	Hyo-scyamine provides a yellow colour which becomes red on burning while Hyoscine does not produce change of colour.
FPN test	5ml of ferric chloride solution, 45ml of 20% solution of per-chloric acid and 50ml of 50% solution of nitric acid is added to make final solution.	Colour ranging from pink to red, orange or violet or blue colour indicates the presence of phenothiazines.

3.5 Viruddha ahara and its contemporary relevance

Definition

यत् किञ्चिद् दोषमास्त्राव्य न निर्हरति कायतः ।

आहारजातं तत् सर्वं अहितायोपपद्यते ॥

(Ch. Su. 26/85)

The drugs and diet which vitiate dosha and do not expel them from the body are considered as virudhahara/unwholesome food/harmful food.

Relationship with Gara

विरुद्धमपि चाहारं विध्यात् विषं गरोपमम् ।

Viruddha: Incompactibility due to food should be treated like Gara visha.

Types of virudha

18 Types of virudha by Acharya Charaka

यच्चापि देशकाल अग्नि मात्र सात्म्यानिलादिभिः ।

सम्स्कारतो वीर्यतश्च कोष्ठावस्थाक्रमैरपि ।

परिहारोपचाराभ्यां पाकात् संयोगतोपि च ।

विरुद्धं तच्च न हितं हृत्संपद्विधिभिश्च यत् ॥

(C. Su. 26/86-87)

- देश विरुद्धम्** विरुद्धं देशतस्तावदूक्षतीक्ष्णादि धन्वनि ।
आनूपे स्निग्धशीतादि भेषजं यन्निषेव्यते ॥ (Ch. Su. 26/88)
Intake of dry and sharp substance in desert and oily and cold foods in marshy land: Desert land is vata predominant, if dry and sharp substance is taken here it aggravates vata. Marshy lands are kapha predominant the uses of oil and cold foods increase kapha.
- काल विरुद्धम्** कालतोऽपि विरुद्धं यच्छीतरूक्षादिसेवनम् ।
शीते काले तथोष्णे च कटुकोष्णादि सेवनम् ॥ (Ch. Su. 26/89)
Intake of cold and dry foods in winter and pungent and hot food in summer.

3.	अग्नि विरुद्धम्	विरुद्धमनले तद्वदनपानं चतुर्विधम् । (Ch. Su. 26/90) Consuming food not according to Chaturvidha Agni (Sama, Vishama, Teekshna, Mandaaagni).
4.	मात्रा विरुद्धम्	मधुसर्पिः समघृतं मात्रया तद्विरुध्यते ॥ (Ch. Su. 26/90) Intake of honey and ghee in equal quantity.
5.	सात्म्य विरुद्धम्	कटुकोष्णादिसात्म्यस्य स्वादुशीतादिस्वेदनम् । यत्तत् सात्म्यविरुद्धं तु । (Ch. Su. 26/91) Intake of sweet and cold substance by persons accustomed to pungent and hot substance.
6.	दोष विरुद्धम्	विरुद्धं त्वनिलादिभिः । या समान गुणाभ्यासविरुद्धानौषधक्रिया ॥ (Ch. Su. 26/91-92) Utilisation of drugs, diets and regimens having similar qualities with doshas but at variance with the habit of the individual.
7.	संस्कार विरुद्धम्	संस्कारतो विरुद्धं तद्यद्भोज्यं विषवद्भवेत् ॥ एरण्डीसीसकासक्तं शिखिमांसं यथैव हि । (Ch. Su. 26/92-93) Drugs and diet which when prepared in a particular way produce poisonous effects e.g. : Meat of peacock roasted in a castor stick
8.	वीर्य विरुद्धम्	विरुद्धं वीर्यतो ज्ञेयं वीर्यतः शीतलात्मकम् ॥ तत् संयोज्योष्णवीर्येण द्रव्येण सह सेव्यते । (Ch. Su. 26/93-94) Substance having cold potency in combination with hot potency. e.g. : Milk and fish
9.	कोष्ठ विरुद्धम्	क्रूरकोष्ठस्य चात्यल्पं मन्दवीर्यमभेदनम् ॥ मृदुकोष्ठस्य गुरु च भेदनीयं तथा बहु । (Ch. Su. 26/94-95) In krura koshta administration of mild laxative in small dose and administration of strong laxative in large dose in mrudu koshta.
10.	अवस्था विरुद्धम्	श्रमव्यवायव्यायामसक्तस्यानिलकोपनम् । निद्रालसस्यालसस्य भोजनं श्लेष्मकोपनम् ॥ (Ch. Su. 26/96) Intake of vata aggravating food by a person after heavy exercise, sexual act or intake of kapha aggravating food by a person after sleep or laziness.
11.	क्रम विरुद्धम्	यच्चानुत्सृज्य विण्मूत्रं भुङ्क्ते यश्चाबुभुक्षितः । तच्च क्रमविरुद्धं स्याद्यच्चातिक्षुद्रशानुगतः ॥ (Ch. Su. 26/97) If a person takes food before excretory function of urine and faeces and intake of food without appetite or after his hunger aggravated.
12.	परिहार विरुद्धम्	परिहारविरुद्धं तु वराहादित्रिषेव्य यत् । (Ch. Su. 26/98) Consuming ushna veerya ahara after the intake of Varahamamsa.
13.	उपचार विरुद्धम्	सेवेतोष्णं घृतादीश्च पीत्वा शीतं निषेवते । (Ch. Su. 26/98) Drinking sheetajala pana after ushnaghrita intake is considered as upachaara viruddha.
14.	पाक विरुद्धम्	विरुद्धं पाकतश्चापि दुष्टदुर्दुर्साधितम् । अपक्वतण्डुलात्यर्थपाक्वदग्धं च यद्भवेत् ॥ (Ch. Su. 26/99) Consuming food which is over cooked or under cooked.
15.	संयोग विरुद्धम्	संयोगतो विरुद्धं तद्यथाऽम्लं पयसा सह । (Ch. Su. 26/99) Intake of sour substance with milk.
16.	हृत् विरुद्धम्	अमनोरुचितं यच्च हृद्विरुद्धं तदुच्यते । (Ch. Su. 26/100) Which is unpleasant to mind.

17. सम्पत् विरुद्धं	संपद्विरुद्धं तद्विद्यादसंजातरसं तु यत् । अतिक्रान्तरसं वापि विपन्नरसमेव वा ॥ (Ch. Su. 26/100-101) Intake of substances that are not matured, over matured or putrefied.
18. विधि विरुद्धम्	ज्ञेयं विधिविरुद्धं तु भुज्यते निभृते न यत् । तदेवंविधमन्नं स्याद्विरुद्धमुपयोजितम् ॥ (Ch. Su. 26/101) Taking meals in public while talking or laughing.

Acharya Sushruta has not classified viruddhahara based on numbers.

Explanation:-

- | | |
|---------------------|-------------------|
| ❖ संयोग विरुद्धम् | ❖ देह विरुद्धम् |
| ❖ सात्म्य विरुद्धम् | ❖ कर्म विरुद्धम् |
| ❖ देश विरुद्धम् | ❖ मान विरुद्धम् |
| ❖ काल विरुद्धम् | ❖ वीर्य विरुद्धम् |

Exceptions for Viruddha

1. Garlic along with milk. (Lasuna ksheerapaka)
2. Radish juice along with milk.
3. Honey with hot water during emesis.

Rogas caused due to Viruddha

षाण्ड्यान्ध्यवीसर्पदकोदराणां विस्फोटकोन्मादभगन्ध-
राणाम् मूर्च्छामदाध्मानगलग्रहाणां पाण्ड्वामयस्याम-
विषस्य चैव किलासकुष्ठग्रहणीगदानां शोथाम्लपित्त-
ज्वरपीनसानाम् सन्तानदोषस्य तथैव मृत्योर्विरुद्धमन्नं
प्रवदन्ति हेतुम् । (Ch.Chi.23/102-103)

षण्डत अन्धत	Infertility, blindness
विसर्प	Skin eruptions
जलोदर	Ascites
विसर्प	Skin eruptions
उन्मदं	Mental illness
भगन्दरं	Fistula
मूर्च्छा	Fainting
मदं	Intoxication
आध्मानं	Flatulence
गलग्रह	Neck stiffness
पाण्डु	Anemia
आमदोष	Indigestion
किलास	Skin disease
कुष्ठ	Skin disease

ग्रहणि	Digestion disorders
शोफं	Swelling
रक्तपित्तम्	Hemorrhage
ज्वरम्	Fever
पीनसम्	Running nose
सन्तान दोषम्	Genetic issues
मरणं	Death

Chikitsa

तेष्वाशु कुर्यात् संशुद्धिं शमं वा तत्त्वरोधि ।
द्रव्यैस्तैरेव वा पूर्वं शरीरस्याभिसंस्कृति ॥

(A.S.Su. 7/30)

- ❖ Vamana
- ❖ Virechana
- ❖ Use of antagonistic substances to subside the disease caused by viruddhahara.
- ❖ Prior conditioning of the body with similar substances.

सात्म्यत

व्यायाम स्निग्ध दीप्ताग्नि वयस्थबलशालिनाम् ।
विरोध्यपि न पीडायै साम्यमल्पं च भोजनम् ॥

(A.S.Su. 7/31)

Here are the above said categories of people will not be affected with Viruddha.

Contemporary significance

Viruddha ahara concept is understood as food-food interactions, food processing interactions or incompatible diet. The food in wrong combination, which has undergone wrong processing, which is consumed as wrong doses, which is consumed in incorrect time or season, etc. can also be considered as viruddha ahara.

The person who is habitually taking such wrong combination faces various health issues. Even though it's a serious issue but not alerted one.

These viruddha foods acts in the body by their:

- ❖ Opposite properties
- ❖ Opposite activities on the tissues
- ❖ May exert some unwanted effect on the body, when processed in a particular form.
- ❖ Which may produces some undesirable effects, when combined in certain proportion.
- ❖ May produces unwanted effects, if consumed at wrong time.

Virudhahara is capable of producing inflammation in the molecular level, negatively affecting immune system and growth, hormones of etc. We should apply this virudhhara concepts to all food item that we are consuming today. As per new researches (Topographical knowledge), the proteins must not get combined with the starch and carbohydrates, they must be taken separately. As per this, starches always require an alkali medium and the amylase in the saliva contain ptyalin, the enzyme which breakdown starch into maltose. This process continues in the intestine, where more breakdown of maltose into simple sugar like glucose, fructose and galactose occurs. They are absorbed in the intestines and enters the blood stream and perform various activities.

If two categories of food consumed together (carbohydrates, proteins and fats), the proper absorption of one item will be delayed. The fat food delays the secretion

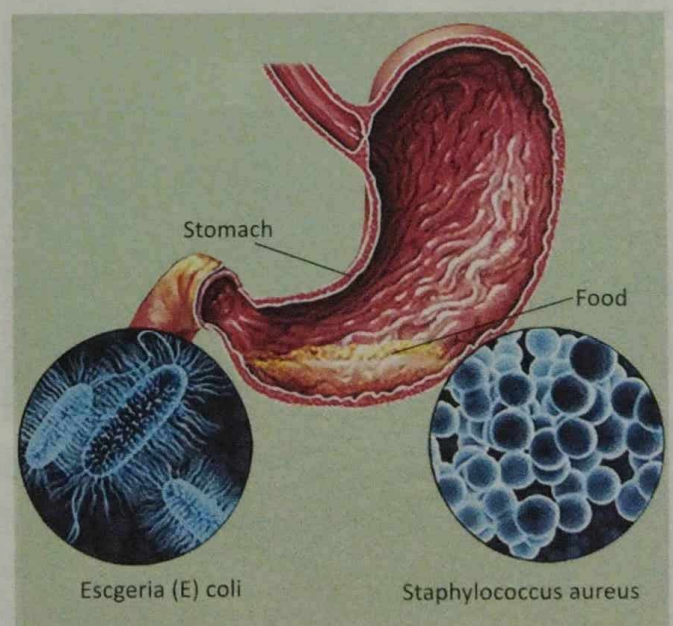
of digestive juices, and reduces the amount of pepsin and HCl, so the proper digestion of protein food does not happens. The unwanted effect of wrong combinations of food is not limited GIT only but may hamper the major systems of the body.

Virudha ahara taken regularly could induce inflammation, at molecular level, disturbing the eicosanoid pathway, creating more arachidonic acid leading to increased prostaglandins-2 and thromboxane. This inflammatory effect is an important effect as these are all the basic pathologies that create *agniman-dhya*, *ama*, and a number of metabolic diseases.

But as per the classics if the person capable of digesting this or having a good digestive fire or exercising regularly will get a less chance of virudha.

3.6 Food Poisoning and Ama Visha

Food poisoning is an illness caused by eating contaminated food.



Classification of Food poisoning

Biological contaminants	Vegetable food poisoning	Animal food poisoning	Stale food	Chemical poisoning	Food allergy
a. Bacterial b. Viral c. Fungal –Ergot	a. Lathyrus sativus b. Argemone mexicanum c. Poisonous mushroom d. Toxic honey e. Minor vegetable poisoning	a. Poisonous fish b. Venomous fish c. Shellfish poisoning	Ptomains	a. Flavouring agents b. Colouring agents c. Preservatives	Egg, fish, meat, milk and peanut

Bacterial food poisoning

Infectious type	Toxic type	Botulism
• Due to the ingestion of pathogenic bacteria • E.g.: salmonella, E coli, Shigella • Presentation: high fever, profuse diarrhoea, vomiting, prostration is less	• It occurs due to the ingestion of preformed toxin in canned food. • Bacteria responsible: Staphylococcus aureus, bacillus cereus, clostridium perfringens. • Exotoxins are not destroyed by boiling. • Presentations: Severe vomiting, diarrhea, fever is absent usually as it is not a direct bacterial infection.	• Food borne botulism is a serious fatal disease but occurrence rate is rare. • It is an intoxication usually caused by the ingestion of potent neurotoxins, formed in contaminated foods. Person to person transmission does not occur • The bacteria clostridium botulinum produces spores which are heat resistant, and in anoxic condition it germinates. • This enters the body through improperly processed food which contains chl.botulinum bacteria. • Symptoms usually appears within 12-36 hours after exposure. • Mortality rate is high • Treatment is given as anti-toxin.

Fungal food poisoning (Mycotoxicosis)

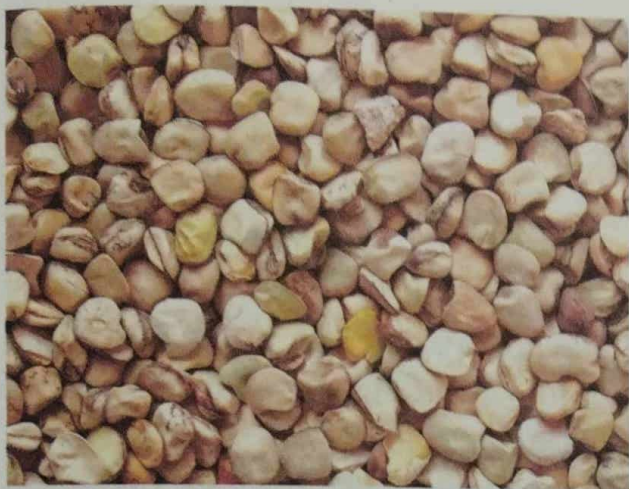
Ergotism



This occurs when a person or an animal eats food that has been contaminated by fungus called *Claviceps purpurea*. It is the most commonly found in rye, but present in other grasses also.

Symptoms include:

- ❖ Headache
- ❖ Nausea
- ❖ Weakness
- ❖ Vomiting
- ❖ Diarrhoea
- ❖ Stomach issues
- ❖ Salivation
- ❖ Excessive sweating
- ❖ Feel thirsty
- ❖ Burning sensation
- ❖ Cold pale skin
- ❖ Speech difficulties
- ❖ Ringing in ears
- ❖ Pregnancy loss

Vegetable food poisoning**Lathyrus sativus**

Chronic intake of kesari-dal leads to the development of Lathyrism. It is an incurable neurological disorder in which non-progressive spastic paralysis, associated with poorly understood degenerative changes in spinal cord, happens.

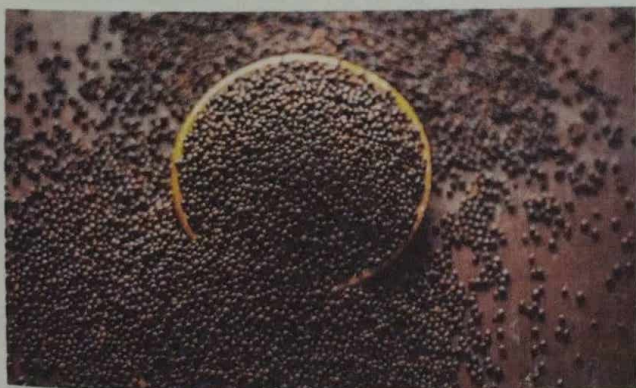
Argemone mexicana

It is also known as Mexican poppy. The seeds resemble Brassica nigra (mustard). Thus, mustard seeds are adulterated with Mexican poppy seeds.

Also, argemone oil is mixed with sunflower oil in India.

The toxic alkaloids are sanguarine and dihydrosanguarine and also benzophenanthridine.

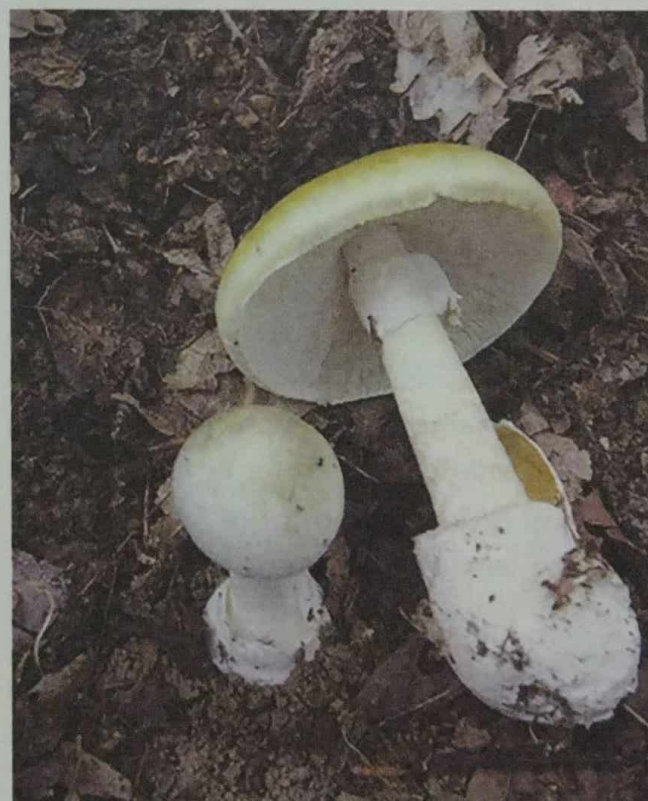
Toxicity causes a disease called epidemic dropsy which is characterised by vomiting, diarrhoea, nausea, swelling of limbs, erythema, pitting oedema and breathlessness.

**Poisonous Mushroom**

Death cap (*Amantia phalloides*) is the commonest poisonous mushroom, which produces poisons: Amatoxins, phallotoxins and virotoxins.

Fatal period: 6-24 hours

Fatal dose: 2-3 mushrooms

**Clinical Features**

Mainly abdominal pain, vomiting and diarrhoea lasting about one day, excessive salivation, perspiration, watering eye, slowed and difficult breathing, dilated

pupils, confusion and excitability are clinical features that the patient shows.

Signs of serious involvement of liver, kidney and CNS soon appear, which causes decrease in the urinary output and a lowering of blood sugar, and this situation leads to coma. It causes death in case of 50% cases.

Chemicals Poisoning

Chemical contaminants of food include heavy metals, pesticides and food additives. Food additives may be antioxidants, flavouring agents, colouring agents, sweetening agents, thickening agents or preservatives.

Monosodium Glutamate (MSG)



Common name: Ajinomoto, Chinese seasoning made from glutamic acid

Ingestion of large amount of MSG causes Chinese restaurant syndrome (CRS), clinically presented as burning sensation, numbness of the face, trunk upper limb, flushing, chest pain, headache, nausea, rarely bronchospasm and angioedema. In young children, a convulsive attack may occur (shudder attack).

Food Poisoning Diagnosis and Treatment

For diagnosis, blood and urine tests helps to identify the toxin involved. Sometimes the blood test may reveals the severity of

poisoning but these tests are limited to some toxins.

Preventive methods

- ❖ Intake of properly stored and cooked foods, especially frozen, canned foods.
- ❖ By strict governing policies in food industry by the government from agriculture fields to storage of foods.
- ❖ Staying hydrated as fluid loss occurs due to vomiting and diarrhoea due to poisoning.
- ❖ Oral rehydration with salt solution is recommended.
- ❖ Hospitalisation & IV fluids administration.
- ❖ Antibiotics may be prescribed if the cause of food poisoning is detected. In case of bacterial, parasitic, protozoan infestations, specific antibiotic is administered.
- ❖ Drugs to stop diarrhoea.
- ❖ Botulism antitoxin- Botulism immunoglobulin can be given within 72 hours of botulism.
- ❖ Symptomatic and specific management for other symptoms.

Amavisha

विरुद्धाध्यशनाजीर्ण शीलिनो विषलक्षणम् ॥

आमदोषं महाघोरं वर्जयेद्विषसंज्ञकम् ।

विषरूपाशुकारित्वाद्विरुद्धोपक्रमत्वतः ॥

(A. H. Su. 8/13-14)

The person who continuously takes *virudhasana* (incompactile food) and overeats, develops *ajeerna* and *ama* in the body, and shows symptoms of *visha* manifestations. Such ailments are incurable because of their severity.

Summary

Food contamination can occur from multiple sources includes natural as well artificial. The health implications can happens from a small gastroenteritis to fatal cases like hepatic, renal and neurological diseases.

Classifications of food contamination

1. Physical contamination
2. Chemical contamination
3. Biological contamination
4. Allergenic contamination

Pancha vidha visha pariksha

Savisha anna if taken internally: makshika and vaayasa etc. dies (**Rasa**),

If vishannas are taken into agni: Chadachadayathe (**shabda**), mayoora kanta Pratima and bhinna (split) dhoomam (**roopa**),

If theekshna dhooma and na chirat cha upasamyathi (not gets subsides easily) is present (gandha).

Animal behaviour change due to poisoned food exposure

- ❖ **Jeevajeevaka:** Marana/death
- ❖ **Kokila:** Swara vaikrityam /sound becomes abnormal.
- ❖ **Krouncha:** Intoxicated or agitated.
- ❖ **Mayoora-udwigna:** Peacock which is cheerful or agitated.
- ❖ **Suka-krosata:** Parrots and mynahs cries due to fear.
- ❖ **Hamsa-shveda:** Swan makes more sound.
- ❖ **Bhringaraja-koojati:** The Bhringaraja birds hoots.
- ❖ **Prushata-asru visarjati:** Spotted deer sheds tear.
- ❖ **Markata-vishtaam munjati:** Monkey defecates.

Poisoned food: Bashpena urdham prasar-pate-vishanna when puts on fire poisoned fumes raising produces:

- ❖ Hrit peeda: pain in the chest.
- ❖ Bhranthanethratvam: unsteady movements of eyes.
- ❖ Sirodukham: headache.

Rx

- ❖ Nasya and anjana with kushtha lamajjadi yoga.
- ❖ Shireesha rajani chandana pralepa.
- ❖ Chandana pralepa in chest.

Vishanaa is taken in hand

- ❖ Pani daha (Burning sensation in hand).
- ❖ Nakha sata (Falling of the nails).

Rx

- ❖ Pralepa with Shyama indragopa soma and utpala.

Vishanna in amasaya

- ❖ Moorcha–fainting
- ❖ Chardi–vomitting
- ❖ Atisara–loose stools
- ❖ Adhmana–flatulence
- ❖ Daha–burning sensation
- ❖ Vepathu–shivering
- ❖ Indriyaanam vrikriyam–disorders of sense organs.

Rx

- ❖ Asu chardana (immediately vamana should be done) using madanadi yoga with dadhi, udaswit or thandulambu.

Vishanna in pakvashaya

- ❖ Daaham– burning sensation
- ❖ Moorcha– fainting
- ❖ Atisara– loose stools

- ❖ **Thrishna**– thirst
- ❖ **Indriya vaikrutam**– disorders of sense organs
- ❖ **Atopa**–gurgling noise of abdomen
- ❖ **Pandu**– anaemia

Rx

- ❖ Virechanam using neelini ghrita.
- ❖ Internal administration of Dooshivishari agada with madhu or dadhi.

Visha in dravadravya (liquid food)

- ❖ **Vividha raji**: Different coloured lines appears on the surface of liquid food
- ❖ **Phebna**budbuda **janma**: Froth and bubbles appears
- ❖ **Adrisya of Chaya**: Images of other objects will not seen
- ❖ **Appearance of yamala chidra Chaya or vaikruta Chaya**: If the images of objects seen it will be either broken, thin or distorted

Visha in saka-supra-anna-mamsa (poisoned vegetables, soups, foods and meat): The food will be klinna (moist), virasa (tasteless), sadya paryushita (rotten), vigandha (loss of normal freshness).

Visha in bhakshyaphala: Gandha varna rasa heena (loss of natural taste, smell and colour), pakva phala asu viseeryante (rotten), ama phala got ripened easily (raw mangoes and other fruits get rotten quickly or even putrefy).

Food adulteration

It is the addition or removal of any substances to or from food so that the natural composition and the quality of food is affected.

Types

1. Intentional adulteration.
2. Incidental adulteration.
3. Natural adulteration.

4. Metallic adulteration.
5. Packaging hazards.

Tests for food adulterations

Urea in milk

To check urea in milk, mix half tea spoon of milk and soyabean powder, together and shake it well. Wait for 5 minutes. Then dip litmus paper for 30 seconds. If colour turns to red litmus to blue indicates urea in milk.

Boric acid in milk

Take 20 ml of milk in a porcelain dish and add 1.4 ml of concentrated Hydrochloric acid and mix it thoroughly. Dip a strip of turmeric paper in the acidified milk. Appearance of characteristic red colour on the turmeric paper.

Artificial colour in turmeric

Mix a teaspoon of turmeric powder in water. If it settles down at the bottom and turns pale yellow then it is real.

On the other hand adulterated turmeric powder will turn dark yellow after putting it in water.

Artificial colours in pulses

Take a handful of any pulse grind it and then add water to it. If the water develops a bright yellow colour then it has got artificial colours.

Artificial colours in vegetables

Take a cotton piece soaked in water or vegetable oil, rub the outer green surface of a small part of green vegetable/chilli. If the cotton turns green, then it is adulterated with malachite green.

Test for adulteration in honey: Fill a glass of water and add one teaspoon of honey, stir it once, if honey is pure it will settle down at the bottom and does not dissolve in

water. It may form a lump or settle down, adulterated or impure honey may dissolve or create a cloudy appearance.

Vinegar test adulterated honey: Take a glass of vinegar water and add few drops of honey. If the mixture starts forming a foam then it indicate that honey is impure. If no foam found then honey is pure.

Viruddha ahara

It is defined as the wrong food combinations those which produce harmful effects on the body.

Acharya Charaka has mentioned 18 types of viruddha.

Viruddha ahara concept is understood as food-food interactions, food processing

interactions or incompatible diet. The food in wrong combination, which has undergone wrong processing, that which is consumed as wrong doses, which is consumed in incorrect time or season etc can also be considered as viruddhahara.

Food poisoning

It is the illness caused by the infection with microorganisms and ingestion of toxins produced and chemical poisoning.

Causes

- ❖ Bacteria and their toxins
- ❖ Viruses
- ❖ Chemicals
- ❖ Vegetable poisoning

Important Questions MCQ

1. The response of the bird jeevajeevaka after seeing poisoned food
 - a. Cries
 - b. Defecates
 - c. Dies
 - d. Makes sounds
2. The response of the bird prishata after seeing poisoned food
 - a. Cries
 - b. Defecates
 - c. Dies
 - d. Makes sounds
3. Marquis reagent test is used to detect
 - a. Organophosphorous deivatives
 - b. Opium derivatives
 - c. Arsenic compounds
 - d. Metallic poisoning
4. Sanguarine is the toxic principle present in
 - a. Claviceps purpurea
 - b. Argemone mexicanum
 - c. Poisonous mushroom
 - d. Bacterial food poisonin
5. Epidemic dropsy is a very important sign in
 - a. Argemone meicana poisoning
 - b. Ergotism
 - c. Mushroom poisoning
 - d. Bacterial food poisoning

Answer key

- | | | | | |
|------|------|------|------|------|
| 1. C | 2. b | 3. b | 4. b | 5. a |
|------|------|------|------|------|

Learning Objectives

- Explain various sources of exposure of visha like anna, pana, vasthra, abhyanga, lepa, paduka, abharana, etc.
- Define adulteration, describe the method of detection of adulteration and its relevance as per Agadatantra.
- Describe modern analytical methods in the detection of poison.
- Define Virudhaahara, its types and its contemporary relevance.
- Define food poisoning, its types and management, application of Agadatantra in food poisoning.
- Describe about Amavisha.

Important SAQ

- Briefly explain food poisoning.
- Explain virudhahara its complications.
- Explain the modern toxicological techniques used in poisoning.
- Explain briefly various pancha vidha pariksha for the detection of poisoning.
- Briefly explain adulteration of food and its detection methods.

• • •

Garavisha and Dushivisha

4.1 Garavisha

Definition

Garavisha or Kritrima visha is administered along with food.

गरसंयोगजं चान्याद् गरसंज्ञं गदप्रदम् ।

कालान्तरविपाकित्वान्नातदाशु हरत्यसून् ॥

(Ch. Chi. 23/14)

Garavisha is a variety of visha which is prepared artificially by the combination of substances either poisonous or nonpoisonous. They are slowly metabolised and do not kill the person so quickly.

नानाप्राण्यङ्गःशमलविरुद्धौषधिभस्मनाम् ।

विषाणां चाल्पवीर्याणां योगो गर इति स्मृतः ॥

(A. H. U. 35/49)

Combination of different body parts of animals or the excreta of different animals, the ashes of drugs with incompactile potency (veerya) and poisonous substances of mild potency is known as Gara visha.

सौभाग्यार्थं स्त्रीयो भर्त्रे राज्ञे वाऽऽरातिचोदिताः ॥

गरमाहारसम्पृक्तं यच्छुन्यासन्नवर्तिनः

(A. H. U. 35/48)

Women in order to gain the love of their husbands and women who are intimate with king, instigated by foes, administer Gara in food to them.

Signs and Symptoms

तेन पाण्डुः कृशोऽल्पाग्निः कासश्वासज्वरार्दितः ॥

वायुना प्रतिलोमेन स्वप्नचिन्तापरायणः ।

महोदरयकृत्प्लीही दीनवाग्दुर्बलोऽलसः ॥

शोफवान् सतताध्मातः शुष्कपादकरः क्षयी ।

स्वप्ने गोमायुमार्जारनकुलव्याल वानरान् ॥

प्रायः पश्यति शुष्कांश्च वनस्पतिजलाशयान् ।

मन्यते कृष्णमात्मानं गौरो, गौरं च कालकः ॥

विकर्णनासानयनं पश्येत्तद्विहतेन्द्रियः ।

(A. H. U. 35/50-53)

पाण्डु	Paleness
कृश	Emaciated
अल्पाग्नि	Weak digestive fire
कास श्वास ज्वरार्दित	Cough, dyspnoea, feverish
वायुना प्रतिलोमेन	Upward movement of Vata
स्वप्नचिन्ता पारायण	Spending more time in sleeping & worrying
महोदर यकृत् प्लीहि	Enlarged abdomen, liver, skin and their diseases
दीनवाक् दुर्बलो अलस	With timid, feeble voice debilitated
शोफवान्	Develops swelling
सतताध्मात	Distention of abdomen always
शुष्कपादकरक्षयि	Dryness of feet and hands
स्वप्ने गोमायु मार्जार नकुल व्याल वानरान्	Seeing animals in dreams such as Jackal, cat, mongoose, snake, monkey

शुष्क वनस्पति जलाशयान्	Dryness of trees and water reservoirs
मन्यते कृष्णं आध्मानम् गौरो गौरं च कालक	Seeing white as black and black as white
विकर्णनासा नयनं	Sees his ears, nose, eyes, etc. rough and distorted
विहतेन्द्रिय	As if no indriyas present

Prognosis

गरातो नाशमाप्नोति कश्चित्सद्योऽचिकित्सितः ।

(A. H. U. 35/54)

Patient dies very soon if no proper treatment is given.

Treatments

गरातो वान्तवान् भुक्त्वा तत्पथ्यं पानभोजनम् ॥

शुद्धहृच्छीलेयद्वेमे सूत्रस्थानविधेः स्मरन् ।

(A. H. U. 35/55)

Patient of artificial poisoning should be made to vomit to cure him.

Foods and drinks (Pathya)

For Hridaya Shuddhi –Hema/(Gold) leha

Importance of swarna for Hridaya Shuddhi

विषभुक्ताय दद्याश्च शुद्धायौर्धमधस्तथा ।

सूक्ष्मं ताम्ररज काले सक्षौद्रं हृदिशोधनम् ॥

शुद्धे हृदि तत् सक्षौद्रं हेमचूर्णस्य दापयेत् ।

न सज्जति हेमपाङ्गेः पद्मपत्रे अम्बुवत् विषम् जायते
विपुलम् ॥ (A. S. Su. 7)

Agadapana

Thapyadi Leha

शर्कराक्षौद्रसंयुक्तं चूर्णं ताप्यसुवर्णयोः ।

लेहः प्रशमयत्युग्रं सर्वयोगकृतं विषम् ॥

(A. H. U. 35/56)

Tapya (Swarna Makshikam), Suvarna (gold) —Powders of these ingredients mixed with *sarkara* and *kshoudram* which have been indicated in *sarvayoga visha*.

Murvadi churnam

मूर्वामृतानतकणापटोलीचव्यचित्रकान् ॥

वचामुस्तविवडङ्गानि तक्रकोष्णाम्बुमस्तुभिः ।

पिबेद्रसेन वाऽम्लेन गरोपहतपावकः ॥

(A. H. U. 35/57-58)

Ingredients such as murva, amruta, nata, kana, patola, chavya, chitraka, vacha, musta and vitanga are powdered and taken along with takra, ushnaambu, mastu or any other amla dravya, which is capable of curing agninaasa occurred due to gara visha.

पारावतामिषशठीपुष्कराह्वाशृतं हिमम् ।

गरतृष्णारुजाकासाश्वासहिध्माज्वरापहम् ॥

(A. H. U. 35/59)

Pigeon meat, Sati, Pushkaramoolam made into him a form, which is prescribed for gara and other ailments.

Nagadanti ghritam

नागदन्तीत्रिवृद्धन्तीद्रवन्तीस्नुक्पयः फलैः ।

साधितं माहिषं सर्पिः सगोमूत्राढकं हितम् ॥

सर्पकीटविषार्तानां गरार्तानां च शान्तये ।

(Ch. Chi. 23/241)

Ingredients

नागदन्ति

त्रिवृत्

दन्ति

द्रवन्ति

स्नुहि क्षीरम्

Using these ingredients prepared ghrita formulation in mahisha ghrita

Indications: Sarpa visha, keeta visha, gara visha.

4.2 Dushivisha

कालान्तरप्रकोपि विषं दूषि विषम् ।

(Ch. Chi. 23/Chakrapani)

यस्माद्दूषयते धतून् तस्माद्दूषीविषं स्मृतम् ।

The visha in the body vitiates, after a period of time is called Dushivisha.

Definition

यत् स्थावरं जङ्गमकृत्रिमं वा
देहादशेषं यदनिर्गतं तत्।
जीर्णं विषघ्नौषधिभिर्हतं वा
दावाग्निवातातपशोषितं वा ॥

स्वभावतो वा गुणविप्रहीनं

विषं हि दूषीविषतामुपैति ॥ (Su. Ka. 2/24-26)

Dooshivisha is either *Sthavara visha* or *Jangama visha* which is not fully eliminated from the body despite treatment by some medicines de-potentiated due to the effects of forest fire, wind or naturally has less potency. Due to its mild potency, it should not be feared much. It is covered with kapha and remains in the body for many years.

Aggravating factors

प्राग्वाताजीर्णशीताभ्रदिवास्वप्नाहिताशनैः ।

दुष्टं दूषयते धातूनतो दूषीविषं स्मृतम् ॥ (A.H.U.35/37)

Because it gets aggravated by eastern breeze, indigestion, cold climate, day sleep, and indulgence in unsuitable food and then vitiates the dhatus. It is called Dooshi visha.

Purvarupa

निद्रा गुरुत्वं च विजृम्भणं च

विश्लेषहर्षाथवाऽङ्गमर्दः । (Su. Ka. 2/29)

- ❖ Sleepiness
- ❖ Loose joints
- ❖ Heaviness
- ❖ Horripilation
- ❖ Yawning
- ❖ Body pain

Signs and Symptoms**According to Charaka**

दूषीविषं तु शोणितदुष्ट्यारुः किटिमकोठलिङ्गं च ।

विषमेकैकं दोषं संदूष्य हरत्यसूनेवम् ॥

(Ch. Chi. 23/31)

Dooshivisha vitiates rakta and causes Aru kushtha, Kitima kushtha, Kota, etc. It affects each dhatu and kills the patient immediately.

तेनार्दितो भिन्नपुरीषवर्णो

दुष्टास्त्ररोगी तृडरोचकार्तः ॥

मूर्च्छन् वमन् गदगदवाक् विमुह्यन्

भवेच्च दूष्योदरलिङ्गजुष्टः ।

आमाशयस्थे कफवातरोगी

पक्वाशयस्थेऽनिलपित्तरोगी ॥

भवेन्नरो ध्वस्तशिरोरुहाङ्गोः

विलूनपक्षः स यथा विहङ्गः ।

स्थितं रसादिष्वथवा विचित्रान्

करोति धातुप्रभवान् विकारान् ॥ (A. H. U. 35/33-36)

अर्दित	Facial palsy
भिन्नपुरीष वर्ण	Discoloured Diarrhoea
दुष्टास्त्ररोगि	Dushta rakta janya roga
मूर्च्छन्	Fainting
वमन्	Vomiting
गदगदवाक् विमुह्यन्	Interrupted speech
मोह	Mental confusion
उदर	Ascites
आमाशये कफ वात रोगि	If situated in aamasaya – kapha vata rogi
पक्वाशये अनिल पित्त रोगि	If in pakwasaya- Anila pitta rogi
विलून पक्ष विहग	Rogi looks like birds without feathers

Prognosis

साध्यमात्मवतः सद्यो याप्यं संवत्सरोत्थितम् ।

दूषीविषमसाध्यं तु क्षीणस्याहितसेविनः ॥

(Su. Ka. 2/55)

Sadhyā: For prudent and judicious person and Dooshi visha with recent origin.

Yapya: One which is more than a year.

Asadhyā: For emaciated and weak patients and who tasks unwholesome foods.

Complications

ज्वरे दाहे च हिक्कायामानाहे शुक्रसंक्षये ।

शोफेऽतिसारे मूर्च्छायां हृद्रोगे जठरेऽपि च ॥

उन्मादे वेपथौ चैव ये चान्ये स्युरुपद्रवाः ।

यथास्वं तेषु कुर्वन्ती विषघ्नैरौषधैः क्रियाम् ॥

(Su. Ka. 2/53-54)

The Updravas of Dooshi visha includes:

- ❖ Fever
- ❖ Burning sensation
- ❖ Hiccup
- ❖ Abdomen distention
- ❖ Depletion of semen production
- ❖ Fainting
- ❖ Diarrhoea
- ❖ Heart disease
- ❖ Abdominal enlargement
- ❖ Insanity and tremors

Management of Dushivisha

दूषीविषार्तं सुस्विन्नमूर्ध्वं चाधश्च शोधितम्।

दूषीविषारिमगदं लेहयेन्मधुनाऽप्लुतम्॥

(A. H. U. 35/38)

- ❖ स्वेदन - Sudation (should be done in advance, opined by Acharya Delhana)
- ❖ स्नेहन - (Oleation therapy)
- ❖ ऊर्ध्वं शोधन - वमन (emesis)
- ❖ अधो शोधन - विरेचन (purgation)
- ❖ शमन चिकित्सा (for alleviating doshas) E.g.: Administration of Doorshivishari Agada

Dooshivishari agada

पिप्पल्यो ध्यामकं मांसी रोध्रमेला सुवर्चिक।

कुटन्नटं नतं कुष्ठं यष्टि चन्दनगैरिकम्॥

दूषीविषारिर्नाम्नाऽयं न चान्यत्रापि वार्यते।

(A. H. U. 35/39)

Pippali, Dhymaka, Mamsi, Lodhra, Ela, Suvarchika, Kutannata, Nata, Kushtham, Yashti Chandana and Gairika should be made paste and administered along with honey.

Extra

Another context of administration of dooshivishgari gulika other than dooshi visha is pakwasaya gata visha where dooshivishaari gulika is administered with dadhi. (Su.ka.2)

4.3 Contemporary Aspects of Gara Visha and Dushi Visha

Garavisha

Gara visha is considered as kritrima visha or artificial poisoning. In the classics, it has been mentioned that gara visha is prepared by the mixture of various substances to produce various diseases. Since it takes some time to get metabolised such type of poison, it never causes instantaneous death of a person. In the current scenario people are exposed to various types of poisons daily either knowingly or unknowingly like fast food, food adulterants, various chemicals, pesticides, environmental pollutants, etc. The alarming increase of severe diseases like cancer, heart attack, stroke, etc. are also attributed to these poisons through our daily foods.

Foods

Some foods contain natural toxicants, which may adversely affect our body. Kesar dal, faba beans, potato shoots and certain varieties of mushrooms may contain toxic components. Thus, they require careful selection, adequate cooking and processing to turn these toxins to non-toxins. Another burning issue is the addition of adulterants into the food for improving the profit. Main disadvantage of food adulteration is that consumer is paying more money and getting low quality products. Some form of adulterations are injurious to health and even causes death. Tea, coffee, honey, chilli powder, etc. are adulterated with some components which may cause severe ailments. Non-nutritious substances which are added intentionally to food generally in small quantities to improve appearance, flavour, texture and storage properties also cause ailments. Food additives can be direct/intentional additives and indirect incidental additives. Sodium

Nitrate, BHA & BHT, Trans fats, Propyl gallate, Monosodium glutamate, etc. are some of the dangerous additives found in our foods which may cause various cancers, behavioural problems, heart failure, kidney failure, etc. Some pesticide residues are also reported from our fruits and vegetables. Defective processing, packaging and unhygienic practices enhance the presence of microorganisms in our foods.

Drugs

Various modern drugs and chemicals are also proved as toxic like erythromycin, aspirin, oral contraceptives, paracetamol, etc. Aspirin can cause acute and chronic overdose effect. Acute effect may be intentional or accidental, and chronic may occur in a day normal daily dose built up in the body. Use of aspirin during viral illness inhibits fat metabolism. This may increase risk of Reye syndrome. Paracetamol is an active metabolite of phenacetin and acetanilide and overdose causes liver damage.

Some Banned Drugs in India - Drug Name, Indications, and Side Effects.

Drugs	Indications	Side effects
Fenfluramine	Obesity	Disease of heart valve, Fibrosis
Phenoformin	Anti-Diabetic	High risk of Lactic Acidosis
Rofecoxib	Arthritic Pain	Heart Attack, Stroke
Nimesulid	Pain Killer	Liver Failure
Phenophthaline	Pain Killer	Cancer

Due to the changing life style, people are exposed to one or other kind of poisons in their day-to-day life. This exposure is in the form of food, drinks, drugs, cosmetics, etc. This concept can be well correlated with gara visha explained in the classical books of Ayurveda. Garavisha concept

is very vast and can be applicable in the elimination aspect also. The treatment principle mentioned in garavisha can be made applicable in similar contemporary conditions. Education and public awareness activities should be conducted to make the people aware of the possible toxins they are exposing through their daily utensils. Eating organic and whole food and make use of organic personal care products may also help to reduce the risk.

Dooshivisha – Contemporary significance

The poison that stays in the body, even after years and is able to produce symptoms and discomfort in the body is called dooshivisha.

There is an important concept called cumulative toxicity very commonly encountering in the present lifestyle. Cumulative toxicity is the adverse effects caused due to the accumulated poisons. An current scenario, the living environment and the lifestyle are changing a lot and people are using more chemicals and exposing to various types of pollutants. The effect is people are reported with various slow poisoning from food and from the environment. This is not mandatory that only direct intake of chemicals lead to cumulative toxicity. Here the concept dooshivisha can be considered as cumulative toxicity as dooshivisha is a slow de-potentiated toxicity occurred after sthavara, jangama, or kritrima visha.

In the modern world, everyone is exposed to mixture of chemical compounds daily, from household toxicants to ambient environmental pollution. Even food-based toxicants exposure may contribute to ill-health. This accumulation of toxicants and potential chronic exposure may lead to an overloaded detoxification pathway, increased systemic inflammation, and clinical ailments such as immune dysfunction or endocrine

disruption. Any drug may culminate in the body when rate of accumulation is more than the rate of elimination.

Contact dermatitis, eczema and various types of allergies are polymorphic inflammation of the skin. It occurs at the site of contact with variety of allergens of antigens. Drug reaction (adverse drug reaction) can occur when Two or more drugs given simultaneously.

4.4 Role of Garavisha and Dushivisha in the Manifestation of Diseases

कालान्तर प्रकोपी विषं दूषीविषम्।

कालान्तर विपाकि विषं गर विषम्॥

Acharya Chakrapani

Dooshivisha which manifests various symptoms in the body which is delayed, as it causes vitiation of different dhatus.

Garavisha gets metabolised slowly in the body and produces symptoms thereafter.

Acharya Sushruta says that the poison by the habitat, season, food and diva-swapna (day sleep), and thereby which vitiates dosha and dhatus are called dooshivisha.

Various lakshana of dushivisha

- ❖ **Atisara** – diarrhoea
- ❖ **Twak vaivarnya** – pigmentation of skin
- ❖ **Mukha dourgandhya** – foul smell from mouth
- ❖ **Virasata** – nausea
- ❖ **Trishna** – thirst
- ❖ **Murcha** – syncope
- ❖ **Vaman** – vomiting
- ❖ **Swara vaikrutya** – hoarseness of voice
- ❖ **Dushyodar** – Ascites
- ❖ **Annamada** – nausea
- ❖ **Avipaka, arochaka** – anorexia
- ❖ **Mandala** – skin blisters
- ❖ **Moha, datukshaya** – weakness

- ❖ **Kotha** – leprosy
- ❖ **Hasta pada sotha** – edema on extremities
- ❖ **Dakodara** – ascites
- ❖ **Chardi** – emesis
- ❖ **Vishamajwara** – fever
- ❖ **Unmada** – insanity
- ❖ **Anaha** – distention
- ❖ **Sukra kshaya** – oligospermia
- ❖ **Swara vikriti** – change in the voice

Dhatu vitiated lakshanas of dushivisha

- ❖ **Rasa dhatu** – aruchi, ajeerna
- ❖ **Rakta dhatu** – kushta, visarpa
- ❖ **Mamsa dhatu** – arbuda (tumor)
- ❖ **Meda dhatu** – medo granthi (lipoma)
- ❖ **Asthi dhatu** – asthidanta vikara (osteological symptoms)
- ❖ **Majja dhatu** – tamodarshana (blurring of vision)
- ❖ **Shukra dhatu** – klaibya (infertility)

Dooshi visha according to Dosha predominance

1. **Vata**: Moha, arati, trishna, murcha, galagraha and phena chardhi.
2. **Pitta**: Kasa, jwara, vamathu, thrishna, klama, daha, atisara and klama.
3. **Kapha**: Swasa, kandu, lalavaman and galagraha.

There are many factors that enhance toxicity. The rate of production of cumulative toxicity in the body depends upon the concentration of chemicals entered into the body. In the body, it is not metabolised properly, so some toxicity precipitated. At this stage, treatment must be applied in order to decrease the toxic effects or else this causes cumulative toxicity. Recent researches say that people who are getting exposed to such xenobiotics (foreign substances) in more or less quantity are the most suffering from the life threatening non-communicable diseases including diabetes mellitus, hypertension, cancer, etc. So to

avoid such complication avoid such types of intake or usage of harmful chemicals.

Gara Visha-Manifestations of Diseases

Features commonly seen in gara visha are:

- ❖ Person who consumes garavisha becomes pale and weak
- ❖ Poor digestion
- ❖ Loss of appetite
- ❖ Flatulence
- ❖ Palpitation
- ❖ Oedema in hands and feet
- ❖ Udara roga
- ❖ Grahani
- ❖ Rajayakshma
- ❖ Gulma
- ❖ Dhatu kshaya
- ❖ Fever

In dreams

- ❖ The person sees wild animals like jackals, monkeys, dried rivers and dried trees.
- ❖ See himself as one without ears and nose.
- ❖ See himself as one fair if he is dark, or dark if he is fair.

Some common garavisha in the current era

- ❖ Preservatives and additives in the soft drinks.
- ❖ Chemical substance present in the carbonated drinks.
- ❖ Artificial sugars/aspartame added to the drinks which is carcinogenic in nature.
- ❖ Synthetic preparation of milk very commonly using now and causes stomach upset.
- ❖ Some commonly used drugs and their complications, paracetamol is hepato toxic is streptomycin and ototoxic.
- ❖ Food adulteration.
- ❖ Cosmetics.
- ❖ Psychoactive drugs.

- ❖ Occupational poisoning.
- ❖ Toxicity due to improperly prepared different bhasmas.

Garavisha and dooshivisha after entering the body, undergo improper metabolism and get deposited in the body, which undergoes detoxification through liver. They cause liver damage also other organs like kidney etc. are also damaged due to accumulated toxicity. Proper diagnosis and timely management of the disease could save the person from the negative effects of dooshi visha and gara visha.

4.5 Research Updates in Garavisha and Dushivisha

1. Contemporary Significance of Gara Visha

Dr. Jyothi Sajayan, Dr. Anusree Mohan

Abstract

Gara visha is a wonderful concept explained by Ayurvedic Acharyas which throw light on the changing life style and possibility of exposure to toxins. Through our daily life activities we are unknowingly exposed to one or other type of toxin. This increases the risk of disorders like stroke, heart attack, cancer, skin ailment, etc. Education and public awareness programme is necessary to make people aware of the risks. Keywords: Gara visha, Ayurveda, Toxins.

2. Gara Visha Manifestation In Skin: A Clinical Case Study

Dr. Hema A. G., Dr. Sharon Jose, Dr. Ambili T. S., Dr. T. S. Krishna Kumar

Abstract

The article is meant to explain the Gara visha involvement in day-to-day activities through a case study. The changing life style, fast food consumption, adulteration in commodities, use of pesticides and other pollutants lead people to be exposed to toxins which are the major

causative factors for ill health. These harmful resources result in exogenous and endogenous toxicities considered as Gara visha.

A male patient aged 46 years complaints of itching, scaling, redness on scalp for four months, after the use of a hair dye. IP level management was given at our institution considering it as Gara visha. The itching and scaling were reduced. Redness over the scalp diminished.

The symptoms manifested were similar to that of *Siroabhyanga Garavisha adhishtana* as per classics and the study revealed that Ayurvedic management was effective in diseases of contemporary world.

Key words: Gara visha, Hair dye, *Siroabhyanga Garavisha adhishtana*.

3. Review of Gara Visha Adhishtanas W.S.R. To Cosmetic Toxicity

Rukma, C. K.* and Shanthi, R. Nair

Abstract

Agadatantra is one of Ashtangas of Ayurveda which is having utmost importance in today's modern era, as humans are exposed to various types of Visha in some way or the other. Present day changing lifestyle along with exposure to poisons mild to severe in form of incompatible food, preservatives, food colouring agents, pesticide induced fruits and vegetables, cosmetics all lead to Gara Visha. The widespread use of cosmetic products has become an issue of public concern, due to the adverse effects on the body. Some of the Gara Visha adhishtanas can be co-related to Cosmetic Toxicity. Ill-effects of these cosmetics can be well explained under context of Gara Visha adhishtana lakshanas. Susruta Acharya describes in Kalpa sthana "Annaraksha kalpa adhyaya" about the various possibilities of contracting Poison from the objects used for massage over body, skin & hair i.e.

Cosmetics on daily basis. Also, prescribes specific Agadas and specific treatments in each of the conditions. There is a need to conduct more research works in future in order to establish the facts explained by Sushrutacharya regarding cosmetic toxicity management, for its universal acceptance.

Keywords: Gara Visha, Agadas, Mukha alepa Visha, Cosmetics, Vishaghna.

4. Physiological concept of hapten-carrier adduct vis-a-vis Garavisha

Saumi Datta 1, Abichal Chattopadhyay 2

Affiliations expand

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❖ DOI: 10.4103/ayu. AYU - 85 - 16

Free PMC article

Abstract

The human body defends itself from harmful agents such as microorganisms present in the environment, which otherwise damage the individual's health. This defensive mechanism is the immune response mediated by the activation of T-cell and B-cell antibody production. The body recognises and destroys these antigenic harmful agents. The defensive response is altered sometimes in the presence of allergens, causing hypersensitive reactions. The allergens are antigens. The hapten-carrier adduct often behaves as an allergen-producing hypersensitivity with a manifestation of sign and symptoms those are at times lethal. *Garavisha* is an artificial type of poison formed by combination of two non-poisonous substances as depicted in the treaties of Ayurveda. It has identical characteristics to that of hapten-carrier adduct. In the present article, *Garavisha* is substantiated with conceptual reference to hapten-carrier adduct and hypersensitivity.

Keywords: Garavisha; Haptens; Hypersensitivity; Visha.

5. Stimulation and inhibition of macrophages prior to immunization with a hapten carrier conjugate.

Abstract

Delayed hypersensitivity reactions and antibody-mediated reactions to the carrier and to the hapten have been studied in animals treated with BCG or /and trypan blue

before immunisation with a hapten-carrier complex. The results show that it is possible to induce, with BCG, at the beginning of the response, an antigenic competition between hapten and carrier moieties of the antigen molecule. Macrophages which modulate the response to the hapten-carrier complex by acting both on T cells involved in cellular immunity and those involved in antibody synthesis, appear to be the target of antigenic competition.

Summary

Gara visha/Kritrima visha/Artificial poisoning

Gara visha is a variety of visha which is prepared artificially by the combination of substances either poisonous or nonpoisonous. They are slowly metabolized and do not kill the person so quickly.

Combination of parts of body or excreta of different animals, incomparable drugs ashes and poisonous substances of mild potency, is known as gara visha.

By the affection of gara visha the person becomes pale, emaciated and with poor digestion, and suffers from palpitation of heart, flatulence, oedema in hands and feet, udararoga, grahani, kshaya, gulma, wasting, fever, and other disorders. In dreams mostly sees cats, jackals, fierce animals, mongoose, monkey, dried rivers, and trees. In dreams having lost his sense organs, he sees himself as fair complexioned though actually being dark complexioned or devoid of ears and nose.

Treatment

1. Sodhana– Sadyo vamana
2. Hrit visodhana– Hemaprasa
3. Agada pana

Dooshi visha/ Weak poisons/Cumulative toxicity

The poison which causes vitiation to dhatus called as dooshi visha.

A constant exposure to particular time, place (anupa desa) and diet as well as a constant and regular day sleep tends to vitiate the dathus of the body is called dushi visha.

It occurs from either sthavara, jangama or kritima visha depending on the stages, these could become the dushi visha.

The person affected with dushi visha presented with diarrhea, discoloration of the skin, becomes a patient of vitiated blood, suffers from thirst, anorexia, fainting, vomiting, stammering speech, and symptoms of ascites.

Management

- ❖ Sodhana (vamana and virechana)
- ❖ Agadapana or samana chikitsa (dushi vishari agada).

Prognosis

- ❖ Dushi visha of recent origin can be easily cured.
- ❖ Dushi visha of 1 year duration can be controlled with proper management.
- ❖ Dushi visha of more than 1 year is said to be asadhya.

Important Questions MCQ

- Kalanthara prakopi visha is**
 - Gara visha
 - Dooshi visha
 - Sankha visha
 - Alarka visha
- Kalaanthara vipaaki visha is**
 - Gara visha
 - Dooshi visha
 - Sankha visha
 - Alarka visha
- Viruddhahra is like**
 - Gara visha
 - Dooshi visha
 - Sankha visha
 - Alarka visha
- Kritrima visha is also known as**
 - Gara visha
 - Dooshi visha
 - Sankha visha
 - Alarka visha
- Anupana of dushivishari gulika in dooshi visha**
 - Madhu
 - Dadhi
 - Madhu and dadhi
 - Ushnambu
- The formulation indicated in garopaha-tapavaka**
 - Vilwadi gulika
 - Dooshi vishari gulika
 - Murvadi churnam
 - Tapyadi leha
- Agra oushadha for gara visha**
 - Murva
 - Swarna
 - Ghrita
 - Sireesha
- Psychiatric manifestations are mainly seen in**
 - Gara visha
 - Dooshi visha
 - Sankha visha
 - Alarka visha
- Nagadanthiyadi ghrita is indicated in**
 - Gara visha
 - Dooshi visha
 - Sankha visha
 - Alarka visha
- Dooshivisha manifested within 1 year is said to be**
 - Sadhya
 - Asadhya
 - Yapya
 - Varjayet

Answer key

1. b	2. a	3. a	4. a	5. a
6. c	7. b	8. a	9. a	10. c

Learning Objectives

- Describe Gara visha, its clinical manifestations and its management principles.
- Describe Dooshivisha, clinical presentations and its management.
- Explain about recent research updates in Gara visha and Dooshi visha, and its etiology for causing diseases in present era and its application in day to day clinical practice.

Important SAQ

- Define dooshivisha and garavisha.
- What is Dooshi vishari agada?
- Explain murvadi churna.
- Write on treatment of dooshi visha.
- Write on treatment of gara visha.

Important LAQ

- Define dooshivisha, mention its clinical features and contemporary significance.
- Define garavisha, write about its clinical features and contemporary significance.
- What are clinical manifestations of garavisha and dooshivisha?
- What are treatment principles of garavisha and commonly used formulations?
- Write on treatment principles of dooshivisha and commonly used formulations.

Visha Upadrava and Diseases Caused Due to Exposure to Visha/Poisons

5.1 Visha Upadrava

ज्वरकासवमिश्वासहिध्मातृष्णातिमूर्च्छनम् ।
विशो भेदोऽतिकाठिन्यमनाहो बस्तिमूर्द्धरुक् ॥
श्वयथु पूतिदंशत्वं रक्तस्रावोविषानिलः ।
इति षोडश निर्दिष्टाः विषार्तानामुपद्रवः ॥

(A. S. U. 47/2)

There are 16 complication of visha—

1. Jwara – Fever
2. Kaasa – Cough
3. Vami – Vomiting
4. Swasa – Dyspnea
5. Hidhma – Hiccough
6. Thrishna – Thirst
7. Murcha – Fainting
8. Vid bheda – Loose motion
9. Ati kadinyam – Constipation
10. Anaha – Abdominal distention
11. Vasti ruk – Pain in the lower abdomen
12. Murdha ruk – Headache
13. Swayathu – Swelling
14. Pooti damsā – Gangrene at bitesite
15. Rakta srava – Bleeding
16. Vishanila – Vitiated vata due to poison

These complications usually subside when the *pradhana vyadhi* is cured, but in visha cases the complications may not subside on its own.

5.2 Drug-induced Toxicity

Definition

Drug-induced toxicity occurs when a medication or drug causes harmful effects on the body, often beyond the intended therapeutic effects resulting in adverse reactions or damage to organs or tissues.

According to WHO: During induced toxicity noxious and unintended response to medicinal products if a medicine is properly, prescribed and administered.

In other words drug toxicity is defined as the undesired effects that may be unpleasant or even dangerous. The drug-induced toxicity occurs either in therapeutic or non-therapeutic dosage. The toxic effects occurring above the therapeutic dosage are often predictable from the pharmacological properties of the drug and often affect all patients.

Causes of Drug toxicity

Drug toxicity occurs because:

- ❖ The drug has effects on the body besides the therapeutic effect.
- ❖ The patient is sensitive to the drug.
- ❖ The drug's action causes other responses that are undesirable or unpleasant.

- ❖ The patient is taking too much or too little of the drug, leading to adverse effects.

Toxicity may occur due to liver or renal (kidney) injury, or effects on multiple organs from drug poisoning:

- ❖ Because oral drugs go directly to the liver (first-pass effect), this exposes the liver to the full impact of the drug; if the drug is irritating or toxic, the liver may be damaged.
- ❖ Some drugs block the capillary network in the renal tubule, damaging the kidney; some drugs are excreted from the kidney unchanged, directly irritating the renal tubule.
- ❖ Poisoning occurs when an overdose of a drug damages multiple body systems, leading to the potential for fatal reactions. Symptoms and treatment vary depending on the drug.

Mechanisms of Drug toxicity

Mechanism of drug toxicity is explaining how the medicines causes harmful or undesired effects on the body, if they are not used in the right way.

- ❖ **On-target adverse effect:** This is the result of the drug binding to its intended receptor, but at an inappropriate concentration, with suboptimal kinetics or in the incorrect tissue.

Example: The administration of hydroxymethyl glutaryl co enzyme-A reductase inhibitors (called statin –clinically used to reduce cholesterol). A rare adverse effect of statin therapy is muscle toxicity, including rhabdomyolysis and myositis. This side effect is due to the physiologic role of HMG CoA reductase in regulating the post translational modification of several muscle proteins, through a lipidation process.

- ❖ **Off-target adverse effect:** This is caused by the drug binding to a target or receptor for which it was not intended.

- ❖ **Production of toxic metabolites:** Usually all metabolites are produced by the liver but, sometimes the metabolites have an adverse effect on the body.

- ❖ **Harmful immune response:** Drugs are xenobiotics (foreign substance) that can be recognised by the immune system as a toxic substance, if the drug is sufficiently large and directly affects the immune system.

Drug Drug Interaction

As the population rises, increased number of patients have been prescribed multiple medications and the potential for drug drug interaction has grown. Numerous adverse reactions have been identified and the mechanism often involved pharmacokinetic and pharmacodynamics effects.

Drug Toxicity Types

- ❖ Cytotoxicity
- ❖ Carcinogenicity
- ❖ Mutagenicity
- ❖ Teratogenicity

Management

- ❖ Avoid usage or banning such types of drugs.
- ❖ Removal of drugs before it is completely absorbed.
- ❖ Copious water irrigation, gastric lavage, emesis, catharsis, forced diuresis and hemo-dialysis-can be done.

Drug-induced toxicity and Agadatantra Drugs

Various modern drugs and chemicals are also proved as toxic like erythromycin, aspirin, oral contraceptives, paracetamol etc. Aspirin can cause acute and chronic overdose effect.

Acute effect may be intentional or accidental, and chronic may occur in a normal daily dose built up in the body. Use of aspirin during viral illness inhibits fat metabolism. This may increase risk of Rey syndrome. Paracetamol is an active metabolite of phenacetin and acetanilide and overdose causes liver damage. Toxic and nontoxic products are produced by the metabolites of paracetamol in the liver. Toxic metabolite is NAPQI, or N-acetyl-p-benzoquinone imine.

Many plant products from *Semecarpus anacardium*, *Abrus precatorius* and, *Aconitum ferox* known to have side effects. Many ayurvedic preparations are also now prepared with dangerous preservatives for improving shelf life. Drugs and Cosmetics Act 1940 suggests that Ayurvedic drugs containing *Ahiphena*, *Arka*, *Bhallataka*, *Bhanga*, *Danti*, *Gunja*, etc. and metals and minerals like As, Hg and Pb cannot be sold as OTC products.

These can be considered as *gara visha* and treatment has to be done according to the *garavisha chikitsa*.

5.3 Occupational Hazards

Occupational hazards are defined as the diseases arising out of or in the course of employment.

Classification

- | | |
|----------------------------|--|
| 1. Physical safety hazards | } Health hazards
–cumulative exposure to harmful conditions |
| 2. Chemical hazards | |
| 3. Biological hazards | |
| 4. Physical hazards | |
| 5. Ergonomic risk factors | |

These are the risk factors in workplace which causes wear and tear on the body and can causes injury. These include repetition,

awkward posture, forceful motion, extreme temperature, noise etc.

❖ **Physical safety hazards:** It is defined as anything that could lead to an injury from workplace. This could be due to slipping, machineries, electrical hazards or any other potentially dangerous condition that could exist in a work place.

❖ **Chemical hazards:** It includes solvents, adhesives, paint, and toxic dust, among other potentially toxic fumes or acids:

- **Gases:** CO₂, CO, HCN, CS₂, NH₃, N₂, H₂S, HCl, and SO₂
- **Dusts (Pneumoconiosis):** Coal dust (anthracosis), silica (silicosis), asbestos (asbestosis, cancer lung), iron (siderosis) and cotton dust (byssinosis).
- **Metals and their compounds:** Lead, mercury, cadmium, arsenic and chromium.
- **Chemicals:** Acids, alkalies and pesticides.
- **Solvents:** Carbon bisulphide, benzene and chloroform.

❖ **Biological hazards:** It includes infectious diseases, molds and toxic or poisonous plants or animal material.

The diseases are brucellosis, leptospirosis, anthrax, actinomycosis, tetanus, encephalitis and fungal infections.

❖ **Physical Hazards:** It includes excessive noise, elevated or low temperatures and radiation.

❖ **Occupational cancers:** Cancer of skin, lungs and bladder.

❖ **Occupational dermatosis:** Dermatitis and eczema.

❖ **Diseases of psychological origin:** Industrial neurosis, hypertension and peptic ulcer.

Occupational hazards and its management through Agadatantra

Agadatantra explains the notion of body burden of toxin under the concept of

dooshivisha or mild poisons. Artificial poisons and their effects are classified as garavisha. The word agada is against gada or rogas. In classics, various single drugs, fomulations and herbo mineral combination have been mentioned for use in treatment.

Diseases caused by virudha ahara, garavisha and dooshi visha are having the same principles of management as Sodhana chikitsa (elimination of toxins), by Vamana or Virechana, according to the seat of vitiated doshas. After sodhana usage of proper and suitable agada formulation could help the disease alleviation an antitoxic formulation acts as blood purifier as most of the visha entering the body is pitta rakta prakopa mainly, and also causes equilibrium of tridoshas. Even it acts very quickly in the body. The agada formulations are helpful in curing the diseases caused by incompactile diet, occupational hazards, etc. and also helps in regaining the healthy status.

5.4 Allergic Manifestations

Allergens are the substances that may cause a hypersensitivity (allergy) of the immune system. After occurring of the hypersensitivity, further exposure to the same substance may result in allergic skin diseases such as allergic contact dermatitis, or allergic air way diseases such as allergic rhinitis or asthma. Occupational allergens are present in many sectors and occupations.

Allergens cause hypersensitivity in two ways:

1. Acquiring hypersensitivity by the immune system (sensitisation) as a result of exposure to allergens.
2. Developing various diseases and affecting other system.

Common occupational allergens are:

- ❖ Natural substances such as flour dust, animal skin and rubber latex.

- ❖ Components in paints and adhesives: epoxy resin components, acrylates and isocyanates.
- ❖ Metals such as nickels and cobalt.
- ❖ Preservatives in cosmetics and other products.

Health effects

Allergic reaction starts within few days to week after exposure and increases on continuous exposure. It depends on the intensity of exposure and duration of exposure, personal sensitivity and the strength of the allergen. Everyone exposed may not develop allergy. The common allergic reactions are on the skin as allergic contact dermatitis, rhinitis and wheezing problems (asthma).

Skin manifestations

Contact dermatitis or eczema is an inflammation of the skin which may results in rashes (redness), itching or pain, nodules, vesicles (blisters), scaling, discolouration, thickened skin, etc.

If the person is having irritant contact dermatitis, chances of developing allergic contact dermatitis are also high.

Management

- ❖ Avoid the contact of allergen.
- ❖ In Ayurveda, kushta chikitsa can be administered, sodhana chikitsa, samana chikitsa along with blood purifying agada formulations can be used.

Allergic rhinitis

It is the inflammation of the nose due to the allergens. Symptoms are nasal congestion, running nose, sneezing and itching irritation.

Occupational Asthma

It is the disease of the airways leading to periodic narrowing of the air way. Symptoms

include breathing difficulty, tightness of chest and cough. If the person is having the history of airway diseases and asthma which exacerbates the allergic asthma.

Occupational asthma has been reported to have increased incidents in hairdressers and cosmetologists, animal handlers, metal industries, food processing and packaging staff.

Common occupational allergens

Agent	Occupation
Flour dust	Food processing, bakery, grain handles
Enzymes	Detergents, food industry, bakery
Plant products	Healthcare, food, agriculture
Wood dust	Furniture, saw mill
Isocyanates	Manufacturing, spray paints, plastics
Metals	Paints, metal plating, welding
Plastics	Adhesives, textiles, coatings

5.5 Endocrine Disruptors

Endocrine disruptors or hormonally active agents are the chemicals or the compounds that interfere with endocrine system.

Endocrine disrupter chemicals (EDCs) are natural or human-made chemicals that mimic, block, or interfere with the body's hormones, which are part of endocrine system. These chemicals cause a wide array of health issues.

EDCs are found in many commonly used products including cosmetics, foods and beverages, toys, carpets and pesticides. Contact with these chemicals may occur through air, diet, skin and water.

Most common endocrine disruptors

- ❖ **Atrazine:** It is commonly used herbicide in the world.

- ❖ **Bisphenol-A (BPA):** It is used to make polycarbonate plastics and epoxy resins.
- ❖ **Dioxins:** These are by products of certain manufacturing industries such as herbicide production and paper bleaching.
- ❖ **Perchlorates:** It is a colourless salt manufactured and used as an industrial chemical to make rockets, explosives and fireworks.
- ❖ **Phthalates:** This is found in a number of products such as cosmetics, food packaging, fragrances, toys and medical devices.

Health Effects

Exposure of EDCs through food, air, skin and water either increases or decrease hormonal level or mimic body's natural hormone, or alter natural production of hormones. This causes significant developmental and biological effects in the body.

EDCs also cause alteration in sperm quality and fertility, abnormalities in sex organs, endometriosis, early puberty, altered nervous system functions, immunity related problems, certain cancers, respiratory problems, metabolic issues, diabetes, obesity, cardiovascular problems, psychiatric issues, learning disabilities and more.

In Agadatantra

Various types of gara visha adhishtana have been explained in Sushruta Samhita Kalpasthana first chapter. Various modes of poisoning and its management have been explained in detail. There are explanations of *mukhalepa visha*, *abhyanga visha* and *visha yukta ahara* and their complications and its management have been clearly explained.

Summary

Visha upadravas

According to Ashtanga sangraha 16 visha upadravas are mentioned.

1. Jwara – Fever
2. Kaasa – Cough
3. Vami – Vomiting
4. Swasa – Dyspnea
5. Hidhma – Hiccough
6. Thrishna – Thirst
7. Murcha – Fainting
8. Vid bheda – Loose motion
9. Ati kadinyam – Constipation
10. Anaha – Abdominal distention
11. Vasti ruk – Pain in the lower abdomen
12. Murdha ruk – Headache
13. Swayathu – Swelling
14. Pooti damsā – Gangrene at bitesite
15. Rakta srava – Bleeding
16. Vishanila – Vitiated vata due to poison.

These are the 16 complications of visha. Usually the complications subside when the pradhana vyadhi cured, but in visha cases the complications may not be subsided by its own.

Drug-induced toxicity

It is defined as diverse array of adverse effects which are brought about through drug use at either therapeutic or non-therapeutic doses.

It is based on

1. On target toxicity

2. Immune hypersensitivity
3. Off target toxicity
4. Bio-activation
5. Covalent modification

Occupational hazards

These are the hazards experiencing in work place. These are the risks associated with working in specific occupations.

This includes many types of hazards including chemical hazards, biological hazards, psychosocial hazards and physical hazards.

Allergic manifestations

Allergens are the substances that may cause a hypersensitivity (allergy) of the immune system. After occurring this hypersensitivity, further exposure to the same substance may result in allergic skin diseases such as allergic contact dermatitis, or allergic air way diseases such as allergic rhinitis or asthma. Occupational allergens are present in many sectors and occupations.

Endocrine disruptors

These are natural or human made chemicals that mimic, block or interfere with body's hormones. These are found in many of the commonly using everyday products including some cosmetics, foods and beverage packaging, toys, carpets and pesticides.

Important Questions

MCQ

1. The reference of Shodasha Vishopadrava is mentioned by:

a. Ashtanga hridaya

b. Ashtanga sangraha

c. Charaka samhita

d. Susruta samhita

2. The number of visha upadhravas are

- a. 14 c. 16
b. 8 d. 12

3. Occupational hazards caused due to iron is called

- a. Anthracosis c. Silicosis
b. Siderosis d. Asbestosis

4. Occupational hazards caused due to cotton dust is called

- a. Anthracosis c. Silicosis
b. Byssinosis d. Asbestosis

Answer Key

1. b 2. c 3. b 4. b

Learning Objectives

- Define Visha upadhravas, describe various drug-induced toxicity and its Agadatantra applications.
- Describe various occupational poisons and their health hazards, and the application of Agadatantra treatment principle in the management of poisoning.
- Define allergy, types of allergens, its understanding as per Ayurveda, discuss the application of treatment principles of Agadatantra in various allergic manifestations.
- Define endocrine disruptors and its Agadatantra perspectives.

Important SAQ

- Enlist visha upadhravas.
- What is drug-induced toxicity and its current relevance?
- Describe occupational hazards and their management through Agadatantra.
- Explain allergic manifestations.
- What is called endocrine disruptors and its relevance in Agadatantra?

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Environmental Toxicology

6.1 Vishakta Vayu, Jala and Bhumi (Air, Water and Land Pollution)

Vishakta vayu lakshana and Chikitsa

धूमेऽनिले वा विषसंप्रयुक्ते
खगाः श्रमार्ताः प्रपतन्ति भूमौ ।

कासप्रतिश्याय शिरोरुजश्च

भवन्ति तीव्रा नयनामयाश्च ॥ (Su. Ka. 3/16)

If smoke and air are poisoned, birds fall to the ground as exhausted, persons develop cough, nasal discharge, headache and severe eye diseases.

Management- Lakshaharidradi oushadha yoga

लाक्षाहरिद्रातिविषाभयाब्द

हरेणुकेलादलवक्रकुष्ठम् ।

प्रियङ्गुकां चाप्यनले निधाय

धूमानिलौ चापि विशोधयेत् ॥ (Su. Ka. 3/17)

This yoga is indicated in *vishayukta vayu* and is known as *lakshaharidradi yoga*. Then *laksha*, *haridra*, *ativisha abhaya*, *musta*, *harenuka*, *eladala* (leaf of ela), *vakra* (*tagara*) *kushta* and *priyangu* should be put on fire and the resulting smoke purifies the air.

Vishakta jala lakshana and Chikitsa

दुष्टं जलं पिच्छिलमुग्रगन्धि फेनान्वितं राजिभिरावृतं च ।
मण्डूकमत्स्यं म्रियते विहङ्गा मत्ताश्च सानूपचरा
भ्रमन्ति ॥

मज्जन्ति ये चात्र नराश्वनागास्ते छर्दिमोहज्वरदाहशोफान् ।
ऋच्छन्ति तेषामपहत्य दोषान् दुष्टं जलं शोधयितुं यतेत् ॥
(Su.Ka.3/7-8)

Poisoned water will be slimy, possesses strong odour and froth and has lines on their surface; frogs and fishes living in such water die of intoxication; birds living in marshy places fly around intoxicated; men, horses and elephants which immerse in this water will develop vomiting, delusion, fever, burning sensation and swelling. The doshas which get aggravated in these animals should be eliminated and attempts made to purify the contaminated water.

Vishakta jala chikitsa - Dhavaswakarnaadi yoga

धवाश्वकर्णासनपारिभद्रान् सपाटलान् सिद्धक-
मोक्षकौ च ।

दग्ध्वा सराजदुमसोमवल्कां स्तदभस्म शीतं वितरेत्
सरःसु ॥

भस्माञ्जलिं चापि घटे निधाय विशोधयेदीप्सितमेवमभः ।
(Su.Ka. 3/9)

Dhava, asvakarna, asana, paribhada, patala, siddhaka, mokshaka, rajadruma and somavalka should be burnt and the ash spread on the water of lakes reservoirs of water and a handful of this ash should be put into the pot containing drinking water to be used when needed.

Vishakta bhumi lakshana and Chikitsa

क्षितिप्रदेशं विषदूषितं तु शिलातलं तीर्थमथेरिणं वा ।।
स्पर्शन्ति गात्रेण तु येन येन गोवाजिनागोष्ठखरा नरा वा ।
तच्छूनतां यात्यथ दह्यते च विशीर्यते रोमनखं तथैव ।।

(Su.Ka.3/10-11)

Ground, surface of stones (boulders), banks of rivers and sand dunes which have been poisoned and which come in contact with the body parts of cows, oxen, horses, elephants, camels, donkeys and men, produces swelling, burning sensation and make hairs and nails to fall off.

Vishakta Bhumi Chikitsa

तत्राप्यनन्तां सह सर्वगन्धैः पिष्ट्वा सुराभिर्विनियोज्य
मार्गम् । सिञ्चेत् पयोभिः सुमृदन्वितैस्तं विडङ्गपाठाकट-
भीजलैर्वा । (Su.Ka.3/12)

The treatment for vishayukta bhumi is the administration of anantha (durva) along with sarva gandha (fragrant drugs such as ela, karpura, etc.) and sweets (honey, jaggery, etc.), made as paste should be dissolved in sura (beer) or water and sprinkled on the poisoned road, or water boiled with vidanga, patha and katabhi be sprinkled.

Environmental Toxicology

It is defined as the multidisciplinary field of science concerned with the study of the harmful effects of various chemicals, biological and physical agents on organisms.

Ecotoxicology is the sub-discipline of environmental toxicology concerned with the study the harmful effects of toxicants on the population and ecosystem levels.

Pollution

Pollution is the introduction of contaminants into the natural environment that cause adverse change. Pollutants the components causing pollution can be either foreign substances/energies or naturally occurring contaminants.

Air pollution

Air pollution is the contamination of the indoor or outdoor environment by any chemical, physical or biological agents that modify the natural characters of the atmosphere.

Household combustion devices, motor vehicles, industrial facilities and forest fires are common sources of air pollution. Pollutants include particulate, matter, carbon monoxide, ozone, nitrogen dioxide and sulfur dioxide.

Health Hazards

Outdoor and indoor air pollution causes respiratory and other diseases and are more important sources of morbidity and mortality.

Air pollution is a main risk factor for a number of pollution-related disorders, including respiratory infections, heart diseases, COPD, stroke and lung cancer. New researches suggest that air pollution exposure is also associated with reduced IQ scores, especially in children, impaired cognition and increased risk of psychiatric disorders such as anxiety and depression. The human health issues related with poor air quality is wide even though it mainly affects respiratory system and cardiovascular system. The variation in clinical symptoms mainly depends on the degree of exposure and human's health status and genetics.

Pollutant	Source	Ill effects
Carbon monoxide	Incomplete combustion of carbon results in carbon monoxide. Breathing of air contain high CO produces reduced oxygen that can be transported in the blood stream to cause harm effects to heart and brain.	At high levels causes Dizziness Confusion Unconsciousness Death
Lead	Major sources – Ores, metal processing, leaded aviation fuels, waste incinerators, lead acid battery manufactures, also from removal of lead from motor vehicle gasoline.	After intake – It enters into blood stream- deposited in the bone depends on levels of exposure; it can adversely affects nervous system, kidney functions, immune system, reproductive system and cardiovascular system.
Ground level ozone	Ozone molecule formed due to dissociation O_2 into separate oxygen atom. Free oxygen can combine to form oxygen molecules to form ozone (O_3).	Breathing of ozone can trigger a variety of health problems including respiratory issues.
Particulate matter	Also called particle pollution, it is mixture of solid particles and liquid droplets found in the air. Some particles such as dust, dirty soot, and smoke body try to eliminate large size particulate matter and small sized matter remains in the lungs.	Decreased lung function, chronic bronchitis, cardiac arrhythmia, heart attacks and premature death.
Nitrogen-dioxide NO_2	It occurs naturally and also by burning of fuel. NO_2 emission occurs from cars, trucks and buses, powder plants, off road equipment.	Inhalation of NO_2 causes severe respiratory symptoms like asthma, coughing, wheezing, sneezing, etc.
Sulfur oxides	Largest source of SO_2 is burning fossil fuel by power plants and by other industrial facilities.	Damages eco system, acid rain form – affects respiratory system. Breathing difficulty, Asthma.

Water pollution



Water pollution happens when harmful substances, often chemicals or microorganisms contaminate a stream, river, lake, ocean or any other water reservoir degrading water quality and making it toxic to humans and to the environment.

Causes

As water is the universal solvent, it can dissolve various types of substances including contaminants. Agriculture sector consumes large part of water resources. It contaminates water in the form of fertilisers, pesticides and animal waste from farm and livestock operations.

Sewage and waste water– Used water is waste water. It comes from the sinks, showers and toilets and from commercial, industrial and agricultural activities. More than 80% of the world's waste water flows back into the environment without being treated or reused. Also, oil spills (oil and gasoline that drip from millions of automobiles,

radioactive substances (generated by uranium mining, nuclear power plants, and the production and testing of military weapons), and radioactive medicines can persist in the environment for thousands of years making their disposal a major challenge.

Land pollution



It results from unsustainable agricultural practices, improper disposal of waste materials (both hazardous and non-hazardous), mining, illegal dumping and littering.

As different waste materials and pollutants like heavy metals, pesticides, plastics litter and pharmaceutical waste pollution the soil, they change and degrade its natural composition. Overtime, some pollutants also go through a chemical transformation, creating secondary pollutants like fumaric and phthalic acids. The higher the permeability of the soil, the more likely that land pollution will occur. Also, the extreme weather events like hurricanes and floods exacerbate the effects of land pollution as they disperse or concentrate certain pollutants.

Effects of Land pollution

- ❖ Contamination of water
- ❖ Polluted soil reduces the fertility thereby decreases the farm production and availability of food.

- ❖ Climate change causes fast floods and disastrous rainfall.
- ❖ Extinction of wild life and plants.
- ❖ Habitat destruction.
- ❖ Increased human health issues, including cancer, respiratory illness, congenital anomalies caused by exposure to harmful chemicals.

Land pollution— Management

- ❖ Sustainable agriculture practices
- ❖ Reforestation
- ❖ Solid waste management
- ❖ Reduce, reuse and recycle
- ❖ Composting

6.2 Effect of Biological, Chemical and Nuclear Warfare

Effect of Chemical and Nuclear Warfare

1. Chemical warfare (CW) defined as the warfare that involves using the toxic properties of chemical substances as weapons/ammunitions.
2. Use of toxins such as ricin, botulinum toxin, etc. fall under this category.
3. Nearly 70 different chemicals are marked as weapons for chemical warfare.
4. Among the weapons of mass destruction (WMD), chemical warfare is probably one of the most brutal created by mankind.
5. CW uses extremely toxic synthetic chemicals that disperse as gas, liquid, or aerosol as agents absorbed to particles to become a powder.
6. Ethyl bromoacetate and chloroacetane were used as chemical weapon during the First World War.

Classification of CW agents

Classification to CW agents in terms of their physiological effects produced on humans is as follows:

1. Nerve agents
2. Vesicants (blistering agents)
3. Blood agents (cyanogen agents)
4. Choking agents (pulmonary agents)
5. Riot –control agents (Tear gas)
6. Psycho-mimetic agents
7. Toxins

Signs and Symptoms

Class of agent	Agent name	Mode of action	Signs and symptoms
Nerve agents	Cyclosarine Sarine	They inactivate enzyme acetylcholinesterases, prevent break down of neurotransmitter acetylcholine in the synapse and causes both muscarinic and nicotinic effect.	Miosis/pinpoint pupil, blurred vision, headache, nausea/vomiting, diarrhoea, sweating, muscle twitching, dyspnoea, seizures and loss of consciousness.
Asphyxiant / blood	Arsine Hydrogen cyanide	Cyanide prevents cellular respiration; so cells go for anaerobic respiration, creating excess lactic acid and causes metabolic acidosis.	Dry red skin, cyanosis, confusion, nausea and seizures.
Vesicant / blisters	Sulphur mustard Nitrogen mustard phosgene	Agents are acid forming compounds, damages skin and respiratory system, resulting in burns and respiratory problems.	Pain and irritation of skin, eyes and mucus membranes skin erythema, blisters, tearing, conjunctivitis and corneal damage.
Choking / pulmonary	Chlorine hydrogen chloride	These are acid forming compounds, damages skin and respiratory system, resulting in burns and respiratory problems.	Airway irritation, eye and skin irritation, dyspnoea, cough, sore throat, wheezing, bronchospasm.
Lacrimation agents	Tear gas Pepper spray	Mode of action It works by irritating mucus membranes in the eye, nose, mouth and lungs.	Severe itching Lacrimation Temporary blindness

Biological Weapons

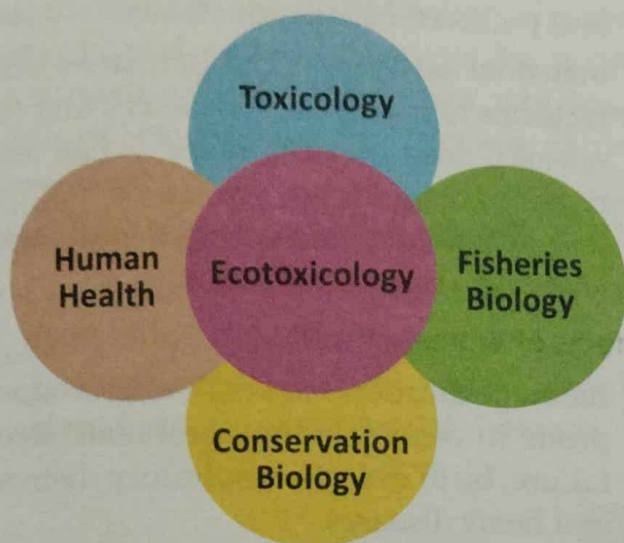
These are microorganisms or toxins found in nature which can be used to incapacitate or kill the enemy.

There are of 3 categories

Category - A	Category - B	Category - C
• High priority agents • Easily transmitted and disseminated result in high mortality and have major public health impact. • E.g.: anthrax, botulism, bubonic plague	• Moderately easy to disseminate and have low mortality rate • E.g.: Brucellosis, vibrio cholera, ricin, abrin	• These are emerging pathogens that might be engineered for mass dissemination because of their easy availability high mortality rate ability to cause major health impact. • E.g.: Nipah, SARS

6.3 Ecotoxicology and Biomagnification

Ecotoxicology



It is the study of the effects of toxic chemicals on biological organisms, especially at the **population, community, ecosystem and biosphere levels**. It is the integration of toxicology and ecology. Ultimate goal of ecotoxicology is to reveal and predict the effects of pollution within the context of all other environmental factors.

Ecotoxicology	Environmental toxicology
Where whole ecosystem or biosphere is concerned	Matters only about human health effects
Effects of toxic chemicals on biological organisms, especially at the population, community, ecosystem and biosphere levels.	Environmental toxicology investigates the effects of toxic agents on individual organisms, organs, tissues, cell types and biochemical reactions.
Multidisciplinary area in which biologists, chemists, geologists, statisticians and computer experts study the toxic effects of pollutants in biological populations, communities and ecosystems.	

Benefits of Ecotoxicology

- ❖ Provides an early warning signal and/or predicts potential environmental damages.
- ❖ Allows realistic estimate of lethal and sublethal effects on organisms.
- ❖ Looks at the impact of contaminants including pesticides on individuals, populations natural communities and ecosystems.

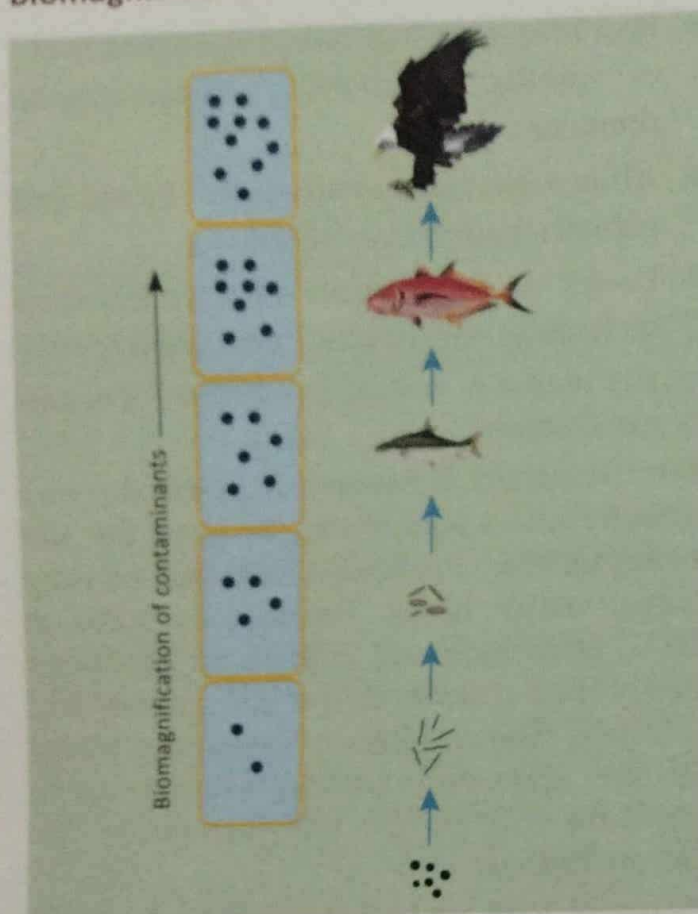
Fate (Transport & export): A pesticide may directly affect something far from the site of application. Pesticides from the soil may travel many miles. Insecticides such as DDT, chlordane and dieldrin do not break easily and remain in the soil, plants and animals. The residues of pesticides found in the arctic and antarctic environments, probably carried by the currents in the ocean and air.

Pesticide built up in living tissues: Pesticide residues built up in organisms and in food webs affect animals and plants. Bioaccumulation can happen if residues build up faster than the organism can break them down and excrete them. Pesticide can affect individual plants and animals in two ways. Firstly, they may cause injury after the plant or animal is exposed to the pesticide directly. This is called direct effects. Secondly, pesticide may cause harm by changing or killing something that the plant or animal needs. This is known as indirect effects.

Community effects: Effects of pesticides can also occur in larger ecological scales than that of the individual. Predator-prey relationship may be deranged by the use of pesticides.

At the ecosystem level: Pesticides and contaminants may affect more than just populations of animals and plants that make up a community. They may also affect basic processes like nutrient cycling or the formation of soil.

Biomagnification



Biomagnification or biological magnification is the process of accumulation of certain chemicals in a living organism to a concentration higher than that occurring in the inorganic, nonliving environment.

It is the increase of contaminated substances caused by the intoxicating environment. The contaminants might be heavy metals such as mercury, arsenic and pesticides such as polychlorinated biphenyls and DDT.

Causes of Biomagnification

- ❖ **Persistence:-** The chemical substance cannot be broken down by environmental process.
- ❖ **Food chain energetics:-** The concentration of chemical substances increases progressively as it moves up in a food chain.
- ❖ **Agriculture:-** The agricultural pesticides, insecticides and fungicides are very toxic and are released into the soil, rivers, lakes and seas.

- ❖ **Organic contaminants:-** Manure and biosolids are processed industrially and contain contaminants like pharmaceutical and personal care products.
- ❖ **Industrial activities:-** The industries and factories release toxic substances that are released into the soil, lakes, ocean and rivers. The gaseous emissions pollute the environment and enter the food chain leading to biomagnification.

Effects of Biomagnification

- ❖ Biomagnification makes humans more prone to cancer, kidney problems, liver failure, birth defects, respiratory distress and heart diseases.

The toxic chemicals accumulate in the important organs and adversely affect the life of animals and their reproductive cycle.

6.4 Toxicovigilance

Toxicovigilance is the process of identifying and evaluating the risk of poisoning that exists within a community, and proposing measures to reduce, eliminate or manage it. It helps in identifying specific circumstances or agents giving rise to poisoning or making certain population suffering a higher incidence of poisoning. By this the emerging toxicological issues can be revealed.

The practice of toxicovigilance often involves the registration of cases of poisoning by health professionals, or analysis of enquiries made by poison control centres. Due to this, toxicovigilance is often one of the core tasks of a poison control centre. Poison control centres help in getting the poisoning statistics including cause of poisoning, incidence of poisoning and severity of poisoning in general population. Also, it records the systematic search for unexpected shift in the recorded causes of poisoning. Pharmacovigilance and environmental health are linked. However, toxicovigilance is a completely a medical

approach and not a statistical one. They are all aspects of the broader concept of public health surveillance. Thus, toxicovigilance can contribute to the identification of public hazards and risk assessment by providing medically validated data which are often overlooked in the process of risk assessment.

Objectives Toxicovigilance Centres

- ❖ Development of course materials which meet industrial and community need.
- ❖ Establishment of centre which helps in identification of potential hazards of pesticides, chemicals and drugs in the community and their prevention.
- ❖ Provides the information regarding the management acute poisoning (drugs/chemicals) through poison information centres.
- ❖ Development of poison database and identification of strategies to prevent the acute and chronic poisoning.
- ❖ Conducting and continuing educational programs, conferences and internship programs for healthcare professionals and students with respect industrial and community needs.

Summary

Vishakta vayu jala and bhumilakshana and Chikitsa

Vishakta vayu lakshana and chikitsa

If smoke and air are poisoned, birds fall to the ground as exhausted, persons develop cough, nasal discharge, headache and severe eye diseases.

Management: Lakshaharidradi oushadha yoga.

Vishakta jala lakshana and Chikitsa

Poisoned water will be slimy, possesses strong odour and froth and has lines on their surface; frogs and fishes living in such water die of intoxication; birds living in marshy places fly around intoxicated; men horse and elephants which immerse in this water will develop vomiting, delusion, fever, burning sensation and swelling. The doshas which get aggravated in these animals should be eliminated and attempts made to purify the contaminated water.

Vishakta jala Chikitsa: Dhavaswakarnaadi yoga.

Vishakta bhumilakshana and Chikitsa

Ground, surface of stones (boulders) banks of rivers and sand dunes which have been

poisoned and which come in contact with the body parts of cows, oxen, horses, elephant, camel, donkey and men, produces swelling, burning sensation and make hairs and nails to fall off.

Vishakta bhumilakshana and Chikitsa: Ananthadi yoga

Effect of biological, chemical, nuclear warfare

Chemical weapons are chemical agents, whether gaseous, liquid or solid that are employed because of their direct toxic effects on humans, animals and plants. They inflict damage when inhaled, absorbed through the skin, or ingested through food or drink.

Biological or nuclear weapons: They cause mass destructions, because they can kill or injure large number of people and cause environmental damage.

Ecotoxicology

It is the study of effects of toxic chemicals on biological organisms, especially at the populations, community, ecosystem, and biosphere levels.

Biomagnification

It is the rise or increase in the contaminated substances caused by the intoxicating

environment. Higher level predators like fish, birds, and marine mammals build up greater and more dangerous amounts of toxic materials than animals lower on the food chain. This biomagnification gives detailed information about the amounts of pollutants in an area.

Toxicovigilance

It is the active process of identifying and evaluating the toxic risks existing in a community, and evaluating the measures taken to reduce or eliminate the contaminants. It is the essential function of poison information centres.

Important Questions MCQ

- Dhavaswakarnadi yoga is indicated in**
 - Vishadushita jala
 - Vishadushita vayu
 - Vishadushita bhumi
 - Vishadushita trina
- The process of accumulation of certain chemicals in a living organism to a concentration higher than that occurring in the inorganic, nonliving environment is called**
 - Toxicovigilance
 - Biomagnification
 - Ecotoxicology
 - Environmental Pollution
- The health effects of contaminants affecting the biosphere is studied in**
 - Toxicovigilance
 - Biomagnification
 - Ecotoxicology
 - Environmental Pollution
- The lakshaharidradi oushadha yoga is indicated in**
 - Vishadushita jala
 - Vishadushita vayu
 - Vishadushita bhumi
 - Vishadushita trina
- Vidanga, pata, katabhi kwatha is indicated in**
 - Vishadushita jala
 - Vishadushita vayu
 - Vishadushita bhumi
 - Vishadushita truna

Answer Key

- | | | | | |
|------|------|------|------|------|
| 1. a | 2. b | 3. c | 4. b | 5. c |
|------|------|------|------|------|

Learning Objectives

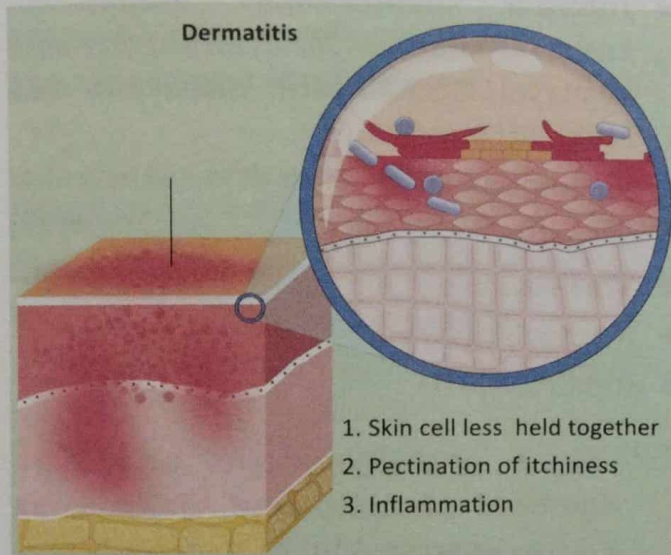
- Define environmental toxicology, describe about Vishakta bhoomi, Vishakta jala, and Vishakta vayu.
- Define pollution and describe various pollutants and explain water pollution, soil pollution, air pollution and their health hazards.
- Explain health effects of biological, chemical and nuclear warfare.
- Define ecotoxicology, biomagnification and Toxicovigilance.

Important SAQ

- What are Vishakta jala lakshana and treatments?
- Describe Vishakta vayu lakshana and treatments.
- Enlist various pollution and role of Agadatantra.
- Explain magnification and its health impacts.
- Explain toxicovigilance.

Dermatological Manifestations of Visha/Poisons

7.1 Contact Dermatitis and its management



Dermatitis: It is the general term for conditions that causes inflammation of the skin. Major examples are:

1. Atopic Dermatitis (Eczema)
2. Contact Dermatitis
3. Seborrheic Dermatitis (Dandruff)

Common symptoms of dermatitis include **red rashes, dry skin and itchiness**.

Contact dermatitis is a skin condition that develops as a reaction to a chemical or other substance. It makes the person uncomfortable. Contact dermatitis is mainly of two types :

1. Allergic contact dermatitis

2. Irritant contact dermatitis

Allergic Contact Dermatitis



Allergic contact dermatitis develops when the skin is exposed to an allergen or foreign substance, which causes some allergic reaction, such as redness, itchiness and dryness, as a result of release of inflammatory chemicals.

Common causes of contact dermatitis include: Jewellery made of nickel and gold, latex, perfumes or chemicals in cosmetics and skin care products.

Irritant Contact Dermatitis



It is the most common type of dermatitis. It occurs as result of contact with a substance that is directly toxic to your skin. No allergy is required for this and it occurs in the first exposure. It occurs due to sufficient inflammation arising from the release of pro-inflammatory cytokines from keratinocytes, usually in response to chemical stimuli.

Many chemicals including industrial cleaning products, solvents, and detergents can cause this condition.

Clinical presentation

Both allergic and irritant contact dermatitis can present with three morphological patterns:

- ❖ **Acute phase:** Erythema, edema, oozing, crusting, tenderness, vesicles or pustules.
- ❖ **Sub-acute phase:** Crusts, scales and hyperpigmentation.
- ❖ **Chronic phase:** Lichenification.

Diagnosis

- ❖ Complete medical history
- ❖ Physical examination and reviewing the symptoms.
- ❖ Patch test (Allergic contact dermatitis) to confirm diagnosis.

Here a sticky patch coated with so many common allergens is placed on the skin, and on removing the patch we can see the allergic reaction triggered with the allergen.

- ❖ Skin culture
- ❖ Skin biopsy

Management

1. Avoidance of known allergens.
2. Washing the exposed area of the skin immediately after the exposure.
3. Take medicines which help in the relief of symptoms. Anti-itch creams, topical or oral anti-histamines, cortico-

steroid creams or prednisone an oral steroid can be used. Immunosuppressant medications are uncommon.

In Ayurveda – Udarda

शीतमारुत संस्पर्शात् प्रदुष्टौ कफमारुतौ
पित्तेन सह संभूय बहिरन्तर्विसर्पत (Maa.Ni.50/1)

In Ayurveda, contact dermatitis can be correlated as Udarda, as per Madava Nidana. Doshas are vitiated due to some external factors and resulted in skin manifestations. The symptoms are redness, itching, slight swelling and rashes on the skin.

Treatments

- ❖ **Internal medications–** Manjishtadi kashaya, Nimbadi kashaya, Aragwathathi kashaya, Guduchyadi kashayam, and Nimbadi churnam.
- ❖ Snehapana
- ❖ Vamana
- ❖ Virechana
- ❖ Kashaya dhara
- ❖ Rakta moksha

7.2 Signs and Symptoms and Management of Abhyanga Visha, Lepa Visha, Vasthra Visha, Paduka Visha, Abharana Visha with Contemporary Relevance

Visha is mainly classified into *sthavara visha*, *jangama visha* and *kritrima visha*. Acharya Vagbhata specifically mentioned that *gara visha* is nothing but *kritrima visha*.

In Sushruta Samhita, *gara visha* adhishthana has been explained. Those *Gara visha* adhishthanas are *anna* (food), *pana* (drinks), *Dantakashta* (tooth brush), *Abhyanga* (oil for massaging), *Avaekhhana* (hair comb), *Utsadana* (Rubbing of body parts with powder), *Kashaya* (decoctions), *Parisheka* (bath), *Anulepana* (application), *Srakshu*

(garlands), *Vasthra* (clothes), *Sayya* (bed), *Kavacha* (cover), *Abharana* (ornaments), *Paduka* (foot wears), *Pada peeta* (foot rest), *Nasya* (inhalation), *Dhooma* (fumigation) and *Anjana* (collyrium).

अने पाने दन्तकाष्ठे तथाऽभ्यङ्गेऽवलेखने ।

उत्सादने कषाये च परिषेकेऽनुलेपने ॥

स्त्रक्षु वस्त्रेषु शय्यासु कवचाभरणेषु च ।

पादुकापादपीठेषु पृष्ठेषु गजवाजिनाम् ॥

विषजुष्टेषु चान्येषु नस्यधूमाञ्जनादिषु ।

लक्षणानि प्रवक्ष्यामि चिकित्सामप्यनन्तरम् ॥

(Su.Sa.Ka.1/25-26)

Abhyanga Visha

पिच्छिलो बहुलोऽभ्यङ्गोः विवर्णो वा विषान्वितः ।

स्फोटजन्मरुजास्त्राव त्वक्पाकः स्वेदनं ज्वर ।

दरणं चापि मांसानां अभ्यङ्गे विषसंयुते ॥

(S.K. 1/51-52)

Taila affected with visha becomes –

Picchila	Slimy
Bahala	Thick
Vivarna	Discoloured
It Produces Sphota	Eruptions on the Skin
Ruk	Painful
Srava	Exudation
Twak Paka	Bursting of Twak/Flesh
Svedana	Burning Sensation
Jwara	Fever

Treatment

तत्र शीताम्बु सिक्तस्य कर्तव्यमनुलेपनम् ।

चन्दनं तगरं कुष्ठमुशीरं वेणुपत्रिका ॥

सोमवल्ल्यमृता श्वेता पद्मं कालीयकं त्वचम् ।

कपित्थरसमूत्राभ्यां पानमेतच्च युज्यते ॥

(Su.K.1/53-54)

❖ *Seka* using *seetambu* (cold water).

❖ *Anulepana*– (External application) using *chandana*, *tagara*, *usira*, *venupathra*, *somavalli*, *amrutha*, *sweta*, *pathmam*, *kaleeyaka* and *twak*.

❖ *Panam*– Using *kapitha rasa* and *muthra*.

Lepa Visha, Vastra Visha, etc. are like Abhyanga visha itself

उत्सादने परीषेके कषाये चानुलेपने ।

शय्यावस्त्रतनुत्रेषु ज्ञेयमभ्यङ्गलक्षणैः ॥ (Su.K.1/55)

Paaduka Visha

शोफः स्त्राव स्तथा स्वापः पादयोः स्फोटजन्म च ॥

भवन्ति विषजुष्टाभ्यां पादुकाभ्यामसंशयम् ।

उपानत्पादपीठानि पादुकावत् प्रसाधयेत् ॥

(Su.K.1/72-73)

<i>Sopha</i>	Swelling
<i>Srava</i>	Discharge
<i>Svapa</i>	Numbness
<i>Sphota</i>	Vesicles on Foot

Treatment

Like Abhyanga visha

तत्र शीताम्बुसिक्तस्य कर्तव्यमनुलेपनम् ।

चन्दनं तगरं कुष्ठमुशीरं वेणुपत्रिका ॥

सोमवल्ल्यमृता श्वेता पद्मं कालीयकं त्वचम् ।

कपित्थरसमूत्राभ्यां पानमेतच्च युज्यते ॥

(Su.K.1/53-54)

❖ *Seka* using *seetambu* (cold water).

❖ *Anulepana*– (External application) using *chandana*, *tagara*, *usira*, *venupathra*, *somavalli*, *amrutha*, *sweta*, *pathmam*, *kaleeyaka*, and *twak*.

❖ *Panam*– Using *kapitha rasa* and *mutra*

Abharana Visha

भूषणानि हतार्चीषि न विभान्ति यथा पुरा ।

स्वानि स्थानानि हन्युश्च दाहपादावदारणैः ॥

पादुकाभूषणेषूक्तत्वमभ्यङ्गविधिमाचरेत् ॥ (Su.K.1/74)

<i>Hatarchi Na Vibhanti</i>	Loss of Lusture
<i>Daha</i>	Burning Sensation
<i>Paka</i>	Suppuration
<i>Avadaranam</i>	Tissue splitting /wound

Treatment

❖ Like *abhyanga visha* management.

Contemporary Relevance of this Topic



Gara visha or *kritrima visha* or artificial poisoning is a vast aspect in Agadatantra and which can be comparable with various sources of exposure of toxins through our daily life activities. Most of the *gara visha adhishtanas* mentioned in Ayurveda classics can be correlated to the resources that we are using daily. Due to the changing life style people are exposed to one or other kind of poisons.

Cosmetics in the form of face creams, lotions, sun screens, lipsticks, sprays, etc. are the part of modern life style. The increasing demand of makeup products has resulted in their massive production without following any standard guidelines. Many of the cosmetic products contain dangerous ingredients such as Hydroquinone, Talcum, Parabens, Pthalates, fragrances and heavy metals like lead and arsenic. These cause skin irritation, allergies, endocrine disruption and even liver toxicity and cancer. In cosmetic toxicity also signs and symptoms usually manifest in different, time periods. Some cosmetic ingredients produce immediate symptoms like non-immunological allergic contact dermatitis immunological dermatitis, contact urticarial syndromes etc.; e.g.: Benzoic acid, cinnamic acid, cinnamal, methyl nicotinate, formaldehyde, etc.

In Sushruta Samhita, various *Gara visha adhishtanas*, are said to have direct link with cosmetic toxicology like *Abhyanga visha*,

anulepa visha, *anjana visha* and *parisheka visha*. Samanya chikitsa of *Gara visha* is *sodhana chikitsa* that is *vamana* (emesis), *virechana* (purgation) along with *hridayavarana* and *swarna prayoga*.

In case of allergic skin manifestation occurred due to *Gara visha adhishtana*, *Samana* (palliative) treatment is more appropriate. Here we can use external and internal therapies with drugs having properties like *pachana* (promoting digestion), *deepana* (kindling digestive fire), especially with *vishahara dravyas* (anti-toxic) properties. Some of the **internal medications** that can be used successfully are:

- ❖ Lodrasevyadi kashaya
- ❖ Guluchyadi kashaya
- ❖ Drakshadi kashaya
- ❖ Murvadi churna
- ❖ Dooshivishari Gulika
- ❖ Dasanga Gulika

External medicines that can be used are:

- ❖ Pathyakshadhathyadi kshalanam (Pouring of medicated water)
- ❖ Neelidaladi keram
- ❖ Paranthyadi keram
- ❖ Sigrupunarnavaadi lepam
- ❖ Kottam tagaradi churnam
- ❖ Triphala churnam etc.

7.3 Signs and Symptoms and management of dermatological manifestations due to cosmetics, chemicals, occupational and other allergens

Allergens are substances that may cause hypersensitivity reactions in the immune system. Chemical allergy develops when the body's immune system overreacts to a chemical. The chemical is labelled as an allergen which causes allergic reactions. Chemical allergies may cause allergic contact dermatitis, or a respiratory reaction such as allergic rhinitis and asthma.

Symptoms of Chemical Allergy

Major symptoms of chemical allergy are:

- ❖ Red or scaly skin
- ❖ Blisters that ooze
- ❖ Burning or itching
- ❖ Swollen eyes or face
- ❖ Hives or skin rashes
- ❖ Dyspnea
- ❖ Wheezing or coughing

**Classification of Cosmetics**

Cosmetics are broadly classified into four types :

1. Skin care products- Cleansers, toners, moisturizers, creams, lotions and sunscreens.
2. Hair care cosmetics- Shampoo, conditioners, hair spray, gel, etc.
3. Colour/make up cosmetics – Primer, concealer, compact powder, foundations mascara, eyeliner, lipstick and lip liner.
4. Fragrances/perfumes.

Allergic reactions to cosmetic products have been increasingly observed. The cosmetic allergens involved can reach the skin in different ways such as by direct application, by occasional contact with an allergen contaminated surface, by transfer, by touching the more sensitive areas, (e.g.: the eyelids) etc. The major cosmetic allergens are described below.

Major Toxic Contents in The Perfumes

Contents	Products	Purpose	Toxicity
BHA & BHT (Butylated hydroxyanisole & butylated hydroxytoluene)	Moisturisers	Anti-oxidant	Endocrine disruption cancer
DEA related ingredients	Moisturisers Shampoo	Thickening agent	Cancer
Parabenes	Body lotions Diaper wipes	Preservative	Endocrine disruption
Fragrance	In almost all cosmetics	Good smell	Clogs lymphatic system, Endocrine disruption, Organ system toxicity
Talc	Eye shadow Blush Baby powder Deodorant Face powder	Absorbent	Lung tumor Ovarian cancer
Formaldehyde	Nail products Hair dye Shampoo Fake eyelashes adhesives	Preservatives	Cancer

Contents	Products	Purpose	Toxicity
Phthalates	Fragrance Perfumes Deodorants Lotions	Solvents and fixatives in fragrances Denaturant.	Headaches, asthma, dermatitis, Endocrine disruption, liver, kidney, lung damage Cancer.
Oxybenzone	Sunscreens	Protect from UVB rays	Contact allergies, photo allergies, Endocrine disruption Organ system toxicity.
p-phenylenediamine	Hair dye	Colouring agent	Skin irritation Liver toxicity Birth defects Cancer

Prevention

- ❖ Healthy life style and avoidance of usage of allergy causing products.
- ❖ Balanced nutrition and healthy food habits.
- ❖ Immunity development.

Occupational Allergens – Signs and Symptoms



Occupational allergens are the allergens to which exposure at work may occur. It causes contact dermatitis, rhinitis and occupational asthma.

Well known examples of occupational allergens are:

- ❖ Natural substances such as flour dust, animal skin, rubber latex.
- ❖ Components in Two-pack paints and adhesives; epoxy resin components, acrylates, and isocyanates.

- ❖ Metals such as nickels and cobalt.
- ❖ Preservative agents in cosmetics, paints, adhesives.

Prevention

- ❖ Occupational allergens have to be identified.
- ❖ As soon as the occupational allergens are identified, proceed with exposure assessment or risk assessment using one of the available risk assessment tools or monitoring at the work place and provide a warning note for the workers.
- ❖ Regulations: Take measures to control occupational allergies where needed.
- ❖ Substitute allergens with suitable less harmful substances.
- ❖ Personal protection measures have to be adopted. (face mask, rubber glove, face shield, aprons, goggles, etc.)
- ❖ Health monitoring
- ❖ Skin cleansing during and after work
- ❖ Skin care – after work is done.

7.4 Dermatological Manifestations Due To Dooshi Visha and Gara Visha

Visha effects in skin (A.S.U.40/19)

शरीरं दूषिते रक्ते सर्वं चिमिचिमायते ।

कोठः समण्डलः स्वेदो रोमहर्षश्च जायते ॥

क्षुद्रकीटा इवाङ्गेषु विसर्पन्तीति मन्यते ।
विनामयति गात्राणि जृम्भते शिशिरप्रियाः ॥
व्यापिन स्तस्य दुष्टस्य दुतस्य विषतेजसा ।
वातादयो वशं यान्ति बलिनोऽप्यबला इव ॥

Vitiated rakta due to visha produces skin eruptions

There is tingling sensation all over the body, reddish eruptions and patches appear, perspiration and horripilations occur, the person feels as minute insects are crawling on the body, bends the body parts, yawns too much and desires cold things. Spreading greatly in the blood and other tissues, the poison by its strength overpowers vata than other doshas even though they are strong.

Gara visha

Gara visha or kritrima visha or artificial poisoning is a combination of two non-poisonous substances. It produces its poisonous effects delayed due to its *kaalaantara vipaki* action. Gara visha enters the body mainly through food preparations. The ingredients in the combination may not be able to make symptoms individually but in a combination it can make signs and symptoms.

There are many Gara visha adhishtanas mentioned in Sushruta Samhita. Some of them having dermatological manifestations are mentioned below:

Vishayukta Abhyanga lakshana

पिच्छिलो बहुलोऽभ्यङ्गो विवर्णो वा विषान्वितः ॥
स्फोटजन्म रुजास्त्राव त्वक् पाकः स्वेदनं ज्वरः ।
दरणंचापि मांसानामभ्यङ्गे विषसंयुते । (S.K.1/51-52)

Signs and Symptoms

Picchila	Slimy
Bahula	Thick
Vivarna	Discoloured
Sphota	Eruptions
Rujasraava	Bleeding
Twak paka	Ulcerations

Svedana	Hot feeling
Maamsa darana	Muscle tearing

❖ Vishayukta anulepana is also like abhyanga lakshana.

Vishayukta Mukhalepa lakshana

मुखालेपे मुखं श्यावं युक्तमभ्यङ्गलक्षणैः ।
पद्मिनीकण्टकप्रख्यैः कण्टकैश्चोपचीयते ॥

(S.K.1/60)

Signs and Symptoms

Mukham syavata	Face discoloured and blackish
Patmini kandaka prakhya	Pimples all over face
kandaka	

Vishayukta Paduka lakshana

शोफः स्त्रावस्तथा स्वापः पादयोः स्फोटजन्म च ।
भवन्ति विषजुष्टाभ्यां पादुकाभ्यामसंशयम् ॥
उपानत्पादपीठानि पादुकावत् प्रसाधयेत् ॥

(S.K.1/72-73)

Sopha	Swelling
Srava	Discharge
Svapa	Numbness
Sphota	Vesicles on Foot

Vishayukta Abharana visha

भूषणानि हतार्चीषि न विभान्ति यथा पुरा ।
स्वानि स्थानानि हन्युश्च दाहपादावदारणैः ॥
पादुकाभूषणेषूक्तमभ्यङ्गविधिमाचरेत् ॥

(S.K.1/72-73)

Hatarchi Na Vibhanti	Loss of Lusture
Daha	Burning Sensation
Paka	Suppuration
Avadaranam	Tissue splitting/wound

Dermatological Manifestations of Dooshi Visha

Dushivisha is either sthavara or jangama visha which is not fully eliminated from the body. It resides in the body and when favourable condition comes produces toxic symptoms by vitiating the Dhatus.

It is cumulative poison and stays in the body for many years as it is covered by kapha dosha. It is a slow acting poison and has less potency. It acts and produces symptoms when favourable situations come. Due to modern lifestyles, we are depended on packet food and junk foods which contain various forms of toxins in the form of chemicals and preservatives. These toxins are consumed and this results in dooshivisha after a period of time.

According to Acharya Charaka

दूषीविषं तु शोणितदुष्ट्याः किटिम कोटलिङ्गं च ।

विषमेकैकं दोषं संदूष्य हरत्यसूनेवम् ॥ (Ch.Chi.23/31)

Dooshivisha vitiates Rakta dhatu and causes symptoms like **kitibha kushtha**, **kota** and **Aru** (it's a type of kshudra kushta).

Non-healing ulcers after bites, especially by snake, occur very widely.

7.5 Dermatological manifestations due to bites and stings

The severity of bites and stings varies according to the type of poison or organism involved and the sensitivity of the person.

Most snake bites commonly produce local tissue oedema and hematologic toxicity. Snake venom can simultaneously damage tissues, affects blood vessels and blood and alter transmission at the neuromuscular junction. Clinical manifestations especially cutaneous lesions occurred due to snake bite as a result of several venom components. For example, local tissue injury resulting from venom metalloproteinase, hyaluronidase and phospholipase A2 causes swelling through disruption of the extracellular matrix and basal membrane surrounding capillary endothelial cells.

When an insect bites, it releases its saliva that cause the skin around the bites to become red, swollen and itchy.

In Ayurveda also, many dermatological manifestations have been explained due to bites and stings.

In Darvikara visha – blackish discolouration in skin: (*twak krishnata*) (Su. Kal. 4/37)

Vega	Lakshana
1st vega – in Rakta	Krishna sonita-blackish discoloured blood Pipeelika parisarna - formication.

Mandali visha

Vega	Lakshana
1st vega – in Rakta	Peetha sonita-yellowish discoloured blood Yellowish discoloured skin Paridaha- burning sensation all over body.
2nd vega – in mamsa	Svayathu –oedema Extensive yellowish discolouration with burning sensation.

Rajila visha

Vega	Lakshana
1st vega - in Rakta	Pandu sonita - whitish discoloured blood Romaharsha - horripilation

Kita visha

Kitas are insects comes under jangama visha. There are vairous types of kitas.

In tikshna visha kita

Sopha: Swelling

Granthi: Growth

Mandalakara pitaka: Rounded skin lesions

Dadru: Skin disease

Visarpa: Eruptions

Kitibha: Skin lesions appearing in this.

In manda visha kita

Pitaka: Skin lesions

Kota: Skin eruptions

Kandu: Itching

Vrishchika visha

Daha: Burning sensation
Sweda: Sweating } Manda visha
 vrishchika

Damsa sophia: Swelling

Spota utpatti: Skin vesicles – Teekshna visha
 vrishchika

Lutha visha

लूतादंशश्च सर्वेऽपि: ददुमण्डलसन्निभा: ।

सितोऽसितऽरुणः पीतः श्यावो वा मृदुरुन्नतः ॥

मध्ये कृष्णोऽथवा श्याव पर्यन्ते जालकावृताः ।

विसर्पवान् शोफयुतस्तप्यते बहुवेदना ॥ (A.H.U.37/56)

Lutha bite site develops swelling like dadru mandala which is white, blackish, red, yellow or blue in colour, soft and elevated black or blue in the centre and sieve like edges. Swelling spreads sideward and is painful.

Vatika lutha	Pittaja lutha	Kaphaja lutha
परुष - Rough	रक्तपीताभ - Red, yellow colouration	कठिन- Hard pale swelling
श्याव- Bluish colour	द्राक्षाफलोपम- Swelling resembling draksha क्लेदि - Exudation	परुषक फलाकृति Resembling a fruit of Parooshaka कण्डू, - Itching

Mushika visha

Mushaka visha refers to rat poisoning which cause various dermatological manifestations. Those manifestations are described below :

शुक्रं पतति यत्रैषां शुक्रदिग्धैः स्पृशन्ति वा ।

यदङ्गमङ्गैः तत्रास्रै दूषिते पाण्डुतां गते ॥

ग्रन्थयोः श्वयथुः कोठो मण्डलानि (A.H.U. 38/4)

When the part of the body which comes in contact with rat's **semen** directly or through cloth contaminated by it, the blood becomes vitiated and pale.

- ❖ ग्रन्थयो – Small nodule
- ❖ श्वयथु – Swelling
- ❖ कोठ – Rashes
- ❖ मण्डलानि – Pigmented patches

Alarka visha

Alarkavisha refers to Rabies, which contains numerous dermatological manifestations like :

विदाह	Burning sensation
राग	Red colour
रुक्	Pain
पाक	Suppuration
शोफ	Swelling
ग्रन्थि	Development of tumor
स्फोट	Appearance of vesicles
मण्डलानि	Round like patches

In short :

- ❖ In cobra bite, local symptoms starts within 6-8 minutes. Small reddish wheal develops which later turns purple blackish with tenderness and burning sensation. Sloughing occurs in 1-2 days.
- ❖ In Viper bite, pain and oozing, local necrosis, gangrene, blisters, and petechial hemorrhages are seen as skin manifestations.
- ❖ In scorpion bite, acute, throbbing, and pricking pain with blackish discolouration of the skin– Paresthesia along with severe burning sensation is present.
- ❖ In spider bite, white, black, reddish, yellowish, soft and elevated lesion occurs which is blackish at the centre and thread like at the periphery. There is also burning sensation, pain and suppuration.
- ❖ In rat bite, and wherever its semen falls, or rat touches, new lesion is formed with pallor, discolouration, nodular swelling, and suppurative lesions, horripilation, chronic ulcer, thick slimy discharge from the wound occur.
- ❖ In alarka visha, there is pain, discolouration, numbness, suppuration, swelling and sometimes blisters, and nodular lesions are found.

- ❖ Bee sting causes severe burning pain, itching and pain.

Sthavara visha causing Dermatological manifestations

- ❖ Strong acids may cause corrosive and burning of the tissues and charring and blackening of the skin with permanent scar.
- ❖ When skin comes in contact with strong alkali, it may have blister and brownish discolouration.
- ❖ Phosphorous may cause subcutaneous hemorrhages, blisters and tissue necrosis.
- ❖ Chlorine causes irritation of skin in swimmers.
- ❖ Mercury poisoning causes skin manifestations like acrodynia/pink diseases, itching, rashes and desquamation of palms and soles.
- ❖ Lead poisoning causes dermatological symptom like pallor on face and alopecia.

- ❖ Arsenic poisoning may lead to alopecia, hyperkeratosis, Aldrich Mee's line on nail and rain drop pigmentations.
- ❖ Copper poisoning may cause contact dermatitis and bluish-green discolouration of skin and gum.
- ❖ **Bhallataka** (*Semecarpus anacardium*) causes bruises and blisters.
- ❖ **Arka** (*Calotropis procera*) causes redness with blisters and excoriation later.
- ❖ **Jayapala** (*Croton tiglium*) causes burning sensation, redness and vesication.
- ❖ **Gunja** (*Abrus precatorius*) causes symptoms like viper snake bite, inflammation, edema, oozing and necrosis.
- ❖ Ergot (*Claviceps purpurea*) produces dry gangrene without swelling and ulceration.

Summary

Contact dermatitis

It is the skin rash caused by contact with a certain substance.

The substance might irritate the skin or trigger an allergic reaction. Some common culprits includes soap, cosmetics, fragrances, jewellery etc. main symptoms include red rashes and itching.

Types

1. Allergic contact dermatitis
2. Irritant contact dermatitis

Gara visha or kritrima visha or artificial poisoning is a vast aspect in Agadatantra and which can be comparable with various sources of exposure of toxins through our daily life activities.

Most of the gara visha adhishtanas mentioned in Ayurveda classics can be

correlated to the resources that we are using daily. Due to the changing life style people are exposed to one or other kind of poisons Cosmetics in the form of face creams, lotions, sun screens, lipsticks, sprays etc. are became the part of modern life style. The demand of makeup products increased recently, have increased resulted in massive production without following any standard guidelines. Many of the cosmetic products contains dangerous ingredients such as Hydroquinone, Talcum, Parabens, Pthalates, fragrances, heavy metals like lead and arsenic. Which produces skin irritation, allergies, endocrine disruption, and even liver toxicity and cancer. In cosmetic toxicity also signs and symptoms usually manifest in different, time periods. Some cosmetic ingredients produce immediate symptoms

like non immunological allergic contact dermatitis, immunological dermatitis, and contact urticarial syndromes etc. eg: Benzoic acid, cinnamic acid, cinnamal, methyl nicotinate, formaldehyde etc.

In Sushruta Samhita various Gara visha adhishtanas, which is having direct link with cosmetic toxicology, like Abhyanga visha, anulepa visha, anjana visha, parisheka visha.

Samanya chikitsa of Gara visha is sodhana chikitsa that is vamana (emesis) virechana (purgation) along with hridayavarana and swarna prayoga.

Occupational allergens are the allergens to which exposure at work may occur. Which causes contact dermatitis, rhinitis and occupational; asthma.

Important Questions

MCQ

1. The three major classification of dermatitis

- Atopic dermatitis
- Contact dermatitis
- Seborrheic dermatitis
- All the above

2. Lichenification occurs in the stage

- Acute stage of dermatitis
- Chronic dermatitis
- Subacute phase
- All the above

3. Kapitha rasa and gomutra pana is indicated in the management of

- Abhyanga visha

- Paduka visha
- Abharana visha
- All the above

4. Pthalates chemicals in cosmetics are added for

- UV protection
- Solvent and fixation of fragrance
- Colouring
- Absorbent

Answer Key

1. d

2. b

3. a

4. b

Learning Objectives

- Describe the clinical presentation, diagnosis and management of Paduka visha, Abharana visha, Vasthra visha, Lepa visha, Abhyanga visha, etc.
- Describe contact dermatitis, its types, its application in Agadatantra.
- Describe dermatological condition caused due to gara visha and dooshi visha and its management principles through Agadatantra.
- Describe diagnosis and application principles of Keeta visha in dermatological manifestations due to bites.

Important SAQ

- Explain the types of contact dermatitis.
- Explain the signs and symptoms of dermatological manifestations caused by cosmetics products.
- Explain abharana visha lakshana and management.
- Explain Paduka visha lakshana and management.
- Explain major dermatological manifestation due to visha.

Therapeutic Utility of Agada Yoga

8.1 Dooshivishari Agada

पिप्पल्यो ध्यामकं मांसी रोध्रमेला सुवर्चिका ।

कुटन्नटं नतं कुष्ठं यष्टी चन्दनगैरिकम् ॥

दूषीविषारिर्नाम्नाऽयं न चान्यत्रापि वार्यते ।

(A. H. U. 35/39)

Ingredients	Botanical name	Family
Pippali	Piper longum	Piperaceae
Dhyamaka	Cymbopogon martini	Poaceae
Jatamansi	Nardostachys jadamansi	Caprifoliaceae
Lodhra	Symplocos racemosa	Symplocaceae

Ingredients	Botanical name	Family
Ela	Elleteria cardomomum	Zingiberaceae
Suvarchika	Tribulus terrestris	Zygophyllaceae
Kutannatam	Oroxylum indicum	Bignoniaceae
Tagara/nata	Valeriana wallichii	Caprifoliaceae
Kushtha	Saussurea lappa	Asteraceae
Yastimadhu	Glycyrrizzia glabra	Fabaceae
Chandana	Santalum album	Santalaceae
Gairika / red ochre	Ferrous oxide	—

Dravya/ Ingredient	Rasa	Guna	Virya	Vipaka	Karma
Pippali	Katu	Laghu (light) Snigdha (unctous) Tikshna (sharp)	Ushna (hot)	Madhura	Kaphavata samana
Dhyamaka	Katu (pungent) Tikta (bitter)	Laghu (light) Ruksha (dry)	Ushna (hot)	Katu (pungent)	Kaphavata samana
Jatamansi	Tikta (bitter) Kashaaya (astringent) Madhura (sweet)	Laghu (light) Snigdha (unctuous)	Sita (cold)	Katu (pungent)	Tridosha samana (vata pitta kapha samana)
Lodhra	Kashaya (astringent) Tikta (bitter)	Laghu (light) Ruksha (dry)	Sita (cold)	Katu (pungent)	Kaphapitta samana
Ela	Katu (pungent) Madhura (sweet)	Laghu (light) Ruksha (dry)	Sita (cold)	Katu (pungent)	Kaphavata samana

Dravya/ Ingredient	Rasa	Guna	Virya	Vipaka	Karma
Suvarchika	Madhura (sweet)	Guru (heavy) Snigdha (unctuous)	Seeta (cold)	Madhura (sweet)	Vatapitta samana
Kutannata	Madhura (sweet) Tikta (bitter) Kashaya (astringent)	Laghu (light) Snigdha (unctuous)	Ushna (hot)	Katu (pungent)	Kaphavata samana
Tagara	Tikta (bitter) Katu (pungent) Kashaya (astringent)	Laghu (light) Snigdha (unctuous)	Ushna (hot)	Katu (pungent)	Kaphavata samana
Kushtha	Tikta (bitter) Katu (pungent) Madhura (sweet)	Laghu (light) Rooksha (dry) Teekshna (sharp)	Ushna (hot)	Katu (pungent)	Kaphavata samana
Yashtimadhu	Madhura (sweet)	Guru (heavy) Snigdha (unctuous)	Seeta (cold)	Madhura (sweet)	Tridosha samana (vata pitta kapha samana)
Chandana	Tikta (bitter) Madhura (sweet)	Guru (heavy) Ruksha (dry)	Seeta (cold)	Katu (pungent)	Kaphapitta samana
Gairika	Madhura (sweet) Kashaya (astringent)	Snigdha (unctuous)	Seeta (cold)	Madhura (sweet)	Kapha pitta samana

Overall properties: All the ingredients are *pittakaphaghna*, *vishaghna* and *raktaprasadaka*.

Indication: Dushi visha, pakvasaya gata visha.

Route of administration: Internal (oral).

Anupana: Madhu (honey) in dooshi visha, dadhi or madhu in pakvasaya gata visha.

Mathra/dose: Guika mathra (1 karsha) in dooshi visha, aksha pramana in pakvasaya gata visha.

Research updates on Dushivishari agada

Pharmacological action of Dushivishari Agada

1. Apoptosis activity-cells are incubated with different concentrations of methanolic extract of dooshivishari agada and cell morphologic change and apoptosis were determined by these studies.
2. Cell cycle arrest- The laboratory study demonstrated that DVA (Dushi Vishari Agada) is having cytotoxic effect with cell cycle arrest.

3. Antimicrobial, antifungal, antioxidant activity – DVA is proved with its antimicrobial action, antioxidant action, antifungal actions.

4. Butyl-cholinesterase activity in Alzheimer's disease of DVA.

5. Anti-allergic action of DVA is proved with anti-inflammatory and immune modulator activity.

6. It is effective against cumulative toxicity and cosmetic induced toxicity,

Reference: <https://ijapr.in/index.php/ijapr/article/view/2576/1849>

8.2 Vilwadi Gulika

बिल्वस्य मूलं सुरसस्य पुष्पं फलं करञ्जस्य नतं सुराह्वम् ।
फलत्रिकं व्योषनिशाद्वयं च बस्तस्य मूत्रेण सुसूक्ष्मपिष्टम् ॥
भुजङ्गलूतोन्दुरवृश्चिकाद्यैर्विसूचिकाजीर्णगरज्वरैश्च ।
आर्तान्नरान् भूतविधर्षितांश्च स्वस्थीकरोत्य-
ञ्जनपाननस्यैः ॥ (A. H. U. 36/84-85)

Ingredients	Botanical name	Family	Parts used	Quantity
Vilwa	Aegle marmelose	Rutaceae	Mula	1 part
Surasa	Ocimum sanctum	Lamiaceae	Pushpam	1 part
Karanja	Pongamia pinnata	Fabaceae	Phala	1 part
Nata	Valeriana wallichii	Caprifoliaceae	Mula	1 part
Surahva/devadaru	Cedrus deodara	Pinaceae	Kanda	1 part
Haritaki	Terminalia chebula	Combretaceae	Fruit	1 part
Vibheetaki	Terminalia bellerica	Combretaceae	Fruit	1 part
Amalaki	Emblica officinalis	Phyllanthaceae	Fruit	1 part
Shunthi	Zingiber officinale	Zingiberaceae	Kanda	1 part
Maricha	Piper nigrum	Piperaceae	Phala	1 part
Pippali	Piper longum	Piperaceae	Phala	1 part
Haridra	Curcuma longa	Zingiberaceae	Kanda	1 part
Daruharidra	Berberis aristata	Berberidaceae	Kanda	1 part

Ingredients	Rasa	Guna	Virya	Vipaka	Karma
Vilwa	Kashaya (astringent) Tikta (Bitter)	Laghu (light) Ruksha (dry)	Ushna	Katu	Kapha vata samana
Tulsi	Katu (pungent) Tikta (bitter)	Laghu (light) Ruksha (dry)	Ushna	Katu	Kapha vata samana
Karanja	Tikta (bitter) Katu (pungent) Kashaya (astringent)	Laghu (light) Snigdha (unctuous)	Ushna	Katu	Kapha vata samana
Tagara	Tikta (bitter) Katu (pungent) Kashaya (astringent)	Laghu (light) Snigdha (unctuous)	Ushna	Katu	Kapha vata samana
Devadaru	Tikta (bitter) Katu (pungent) Kashaya (astringent)	Laghu (light) Ruksha (dry)	Ushna	Katu	Kapha vata samana
Haritaki	Pancharasa (except lavana)	Laghu (light) Ruksha (dry)	Ushna	Madhura	Tridosha samana
Vibhitaki	Kashaya rasa	Laghu (light) Ruksha (dry)	Ushna	Madhura	Kapha pitta samana
Amalaki	Amla pradhana pancharasa	Laghu (light) Ruksha (dry)	Seeta	Madhura	Tridosha samana
Sunti	Katu	Guru (heavy) Ruksha (dry)	Ushna	Madhura	Kapha vata samana
Maricha	Katu	Laghu (light) Ruksha (dry)	Ushna	Katu	Kapha vata samana
Pippali	Katu	Laghu (light) Ruksha (dry)	Ushna	Madhura	Kapha vata samana
Haridra	Tikta (bitter) Katu (pungent)	Laghu (light) Ruksha (dry)	Ushna	Katu	Kapha pitta samana

Ingredients	Rasa	Guna	Virya	Vipaka	Karma
Daruharidra	Tikta (bitter) Kashaya (astringent)	Laghu (light) Ruksha (dry)	Ushna	Katu	Kapha vata samana
Nili	Tikta (bitter)	Laghu (light) Ruksha (dry)	Ushna	Katu	Kapha vata samana
Eeswari	Tikta (bitter) Katu (pungent) Kashaya (astringent)	Laghu (light) Ruksha (dry)	Ushna	Katu	Kapha vata samana
Pata	Tikta	Laghu (light) Ruksha (dry)	Ushna	Katu	Tridosahara
Ajamutra	Katu (pungent) Lavana (salty)	Laghu (light) Ruksha (dry)	Ushna	Katu	Kapha vata samana

Method of Preparation

All the drugs are taken in equal quantity. Proper missing and bhavana or trituration are done in basta mutra (goats urine) in very fine consistency (susukshma pishtam). The bhavana of viwadi gulika is mentioned differently by different acharyas. In general practice, 3-4 of bhavan/day for 6 months or 21 days are done.

Dose: There is no classical opinion on dose of vilwadi gulika. Generally 1000-2000 mg is taken in divided dose.

Application

Internally 2000mg/day is taken in divided dosage.

Indications: *Sarpa damsa* (snake bite), *lutha visha* (spider poison), *unduru visha* (rat poison), *vrishchika visha* (scorpion poisoning), *visuchika* (cholera), *ajirna* (indigestion), *garavisha* (combination of poisons), *jwara* (rise in temperature) and *bhuta badha* (infectious conditions).

Methods of Administration:

Anjana (collyrium), paana (internal administration), nasya (nasal instillation).

Probable mode of action:

- ❖ Most of the drugs are kapha vata samana or tridosha samana/and vishaghna

- ❖ Due to the bhavana dravya basta mutra (laghu), it absorbs into the body quickly, and disintegrates very fast and bio-availability is more.
- ❖ Vilwadi gulika helps to expel toxins from the body due to its rich detoxifying factors
- ❖ Vilwadi gulika is good in carminative properties that improves digestion and appetite
- ❖ The digestive stimulant of vilwadi gulika helps in indigestion
- ❖ The paste of vilwadi gulika can be applied to the affected areas to get rid of wounds
- ❖ The antibacterial and antiviral properties of vilwadi gulika helps in curing gastro-enteritis symptoms
- ❖ The febrifuge properties of vilwadi gulika helps in controlling fever.

Recent Research Updates

Various ingredients of vilwadi agada have anti-oxidant, immune modulatory, anti-inflammatory, anti-ulcerative and hepatprotective actions. Vilwadi agada may act by following way:

- ❖ Prevent synthesis of prostaglandins, which may help as anti-inflammatory

- ❖ It may suppress CYP450 which plays an important role in producing toxic metabolite in liver.
- ❖ It may increase synthesis of glutathione (GSH) in liver and helps in hepato-protective action.
- ❖ It helps in regeneration and production of hepatocytes.

Reference: <https://thevaidyar.com/blog/ingredients-uses-dosages-and-side-effects-of-vilwadi-gulika-bilwadi-gulik>

8.3 Dashanga Agada

वचा हिङ्गु विडङ्गानि सैन्धवं गजपिप्पली।
पाठा प्रतिविषा व्योषं काश्यपेन विनिर्मितम्।
दशाङ्गमगदं पीत्वा सर्वकीटविषं जयेत्।

(A.H.U.37/27-28)

Ingredients	Botanical name	Family	Part used
Vacha	Acorus calamus	Araeaceae	Rhizome
Hingu	Ferula asafoetida	Apiaceae	Resin
Vidanga	Embelia ribes	Myrsinaceae	Fruit
Saindhavam	Rock salt		
Gajapippali	Scindapus officinalis	Piperaceae	Fruit
Patha	Cyclea peltata	Menispermaceae	Root
Prativisha	Aconitum heterophyllum	Ranunculaceae	Root
Shunthi	Zingiber officinale	Zingiberaceae	Rhizome
Maricha	Piper nigrum	Piperaceae	Fruit
Pippali	Piper longum	Piperaceae	Fruit

Karmas of ingredients

Ingredients	Rasa	Guna	Veeya	Vipaka	Karma
Vacha	Katu tikta	Laghu (light) Teekshna (sharp)	Ushna	Katu	Kaphavatahara, mutrajanana Shothaghna
Hingu	Katu	Laghu (light) Snigdha (unctuous)	Ushna	Katu	Kaphavatahara vedanasthapana mutrajanana Shothaghna krimighna
Vidanga	Katu (pungent) Kashaya (astringent)	Laghu (light) Rooksha (dry)	Ushna	Katu	Vatakaphahara krimighna raktasodhana soolaghna varnyashothahara
Saindhavam	Lavana	Rooksha (dry)	Seeta	Madhura	Tridosahara mutrala shoolahara
Gajapippali	Katu	Laghu (light) Snigdha (unctuous)	Anushna Seeta	Katu	Kaphavatahara vedanasthapana sothahara
Patha	Tikta	Laghu (light) Teekshna (sharp)	Ushna	Katu	Tridoshasamana vranasodhana vranaropana daahaprasamana mootrala vishaghna sothahara

Ingredients	Rasa	Guna	Veeya	Vipaka	Karma
Prativisha	Tikta Katu	Laghu (light) Ruksha (dry)	Ushna	Katu	Tridosahara shothahara vedanahara jwaraghna
Shunthi	Katu	Laghu (light) Snigdha (unctuous)	Ushna	Madhura	Kaphavatahara sothahara vedanahara vatanulomana shoolaprasamana sothahara
Maricha	Katu	Laghu (light) Tikshna (sharp)	Ushna	Katu	Kaphavatahara vedanasthapana sothahara
Pippali	Katu	Laghu (light) Tikshna (sharp)	Anushna shita	Katu	Kaphavatahara vedanasthapana sothahara krimighna

Method of Preparation and Administration

Generally, dashanga agada is made into gutika form for easy administration. All the ingredients are taken in equal quantity and made fine powder. As bhavan dravya has not been mentioned, we can use jala or kashaya of the ingredient. Popular visha vaidyas of traditional keralaleeya vishachikitsa use neeli kashaya (*indigofera tinctoria*, fabaceae) as bhavana dravya. It is grinded until drug mass attains the required consistency of rolling the pills. It is dry it under shade and kept in air tight glass containers.

Dose: As per the preparation, if it is made in the gutika form the dose is one karsha.

Indications: It relieves the toxic effects of insect bite.

Mode of Administration: Internal

Recent Research Updates

- ❖ Dashanga agada is a proved anti-inflammatory agent.
- ❖ Many clinical and animal studies of dashanga agada proved its efficacy in toxic bite case especially vrishchika visha.

Reference: <https://jaimes.in/jaimes/article/view/1738/2178>

8.4 Murvadi Agada

मूर्वामृतानतकणापटोलीचव्यचित्रकान् ।

वचामुस्तविडङ्गानि तक्रकोष्णाम्बुमस्तुभिः ।

पिबेद्रसेन वाऽम्लेन गरोपहतपावकः ॥ (A.H.U. 35/57)

(See the table down)

Ingredients	Botanical name	Family	Karma
Murva	Marsdenia tenecissima	Asclepiadaceae	Kaphavatahara
Amrita	Tinospora cordifolia	Menispermaceae	Tridosahara, medhya rasayana kandughna dipana jwarahara
Nata	Valeriana wallichii	Valerianaceae	Kaphavatahara vishaghna
Kana	Piper longum	Piperaceae	Kaphavatahara dipana vrushya rasayana sulaghna
Patoli	Trichosanthes dioica	Cucurbitaceae	Kaphapittahara dipana vrushya
Chavya	Piper chaba	Piperaceae	Kaphavatahara dipana pachana grahi rasayana
Chitraka	Plumbago zeylaniaca	Plumbaginaceae	Vatakaphatahara dipana pachana grahi rasayana
Vacha	Acorus calamus	Araceae	Kaphavatahara medhya
Musta	Cyperus rotundus	Cyperaceae	Kaphavatahara dipana pachana
Vidanga	Embelia ribes	Myrsinaceae	Vishaghna dipana soolahara rasayana krimighna

Drug	Rasa	Guna	Veeya	Vipaka	Karma
Murva	Tikta (bitter) Kashaya (astringent)	Guru (heavy) Ruksha (dry)	Ushna	Katu	Kaphavatahara
Amrita	Tikta (bitter) Kashaya (astringent)	Guru (heavy) Snigdha (unctuous)	Ushna	Madhura	Tridosahara, medhya rasayana kandughna dipana jwarahara
Nata	Tikta (bitter) Katu (pungent) Kashaya (astringent)	Laghu (light) Snigdha (unctuous)	Ushna	Katu	Kaphavatahara vishaghna.
Kana	Katu (pungent)	Laghu (light) Snigdha (unctuous) Tikshna (sharp)	Ushna	Madhura	Kaphavatahara dipana vrishya rasayana shulaghna
Patola	Tikta (bitter)	Laghu (light) Ruksha (dry)	Ushna	Katu	Kaphapittahara deepana vrishya
Chavya	Katu (pungent)	Laghu (light) Ruksha (dry)	Ushna	Katu	Kaphavatahara deepana pachana grahi rasayana
Chitraka	Katu (pungent)	Laghu (light) Ruksha (dry) Tikshna (sharp)	Ushna	Katu	Vatakaphatahara dipana pachana grahi rasayana
Vacha	Katu (pungent) Tikta (bitter)	Laghu (light) Tikshna (sharp)	Ushna	Katu	Kaphavatahara medhya
Mustha	Tikta (bitter) Katu (pungent) Kashaya (astringent)	Laghu (light) Ruksha (dry)	Shita	Katu	Kaphavatahara dipana pachana
Vidanga	Katu (pungent) Kashaya (astringent)	Laghu (light) Ruksha (dry) Tikshna (sharp)	Ushna	Katu	Vishaghna dipana shulahara rasayana krimighna

Mode of Administration: Internal

Anupana

Anupana increases the palatability of medicine or food, also helps compensate the needed properties.

Here anupana for murvadi churna is specifically mentioned. It inches all amla dravyas, (bijapura rasa, kanchi), specifically takra mastu and ushna jala have been mentioned. Indu commentary says mamsa rasa can also be used.

Indications: Garauopahata (pavaka is diminished agni due to gara visha)

Dose: As churna matra (1 karsha).

Recent Research Updates

In day-to-day life, we are exposed to various types of visha either natural or artificial. Here kritrima visha or samyogaja visha is either poisonous or nonpoisonous. This gara visha usually enters the body and causes agnimandhya. In this context of agnimandhya due to gara visha, it consists of 10 ingredients and most of the drugs are katu tikta rasa. Tikta rasa is indicated for curing aruchi, and also due to its deepana pachana action it acts as a good carminative also. This enhances agni or digestive fire. The

four anupana used are laghu, srotosodhana, deepan and so on.

Reference: <https://ijapr.in/index.php/ijapr/article/view/1937/1366>

8.5 Pancha Shirisha Agada

शिरिषफलमूलत्वक्पुष्पपत्रैः समैर्घृतैः ।

श्रेष्ठः पञ्चशिरिषोयं विषाणां प्रवरो वधे ॥

(Cha. Chi. 23/218)

The five parts of Shirisha

1. Phala
2. Mula
3. Twak
4. Pushpa
5. Patra — These are said to be the sreshta among vishahara aushadhas.

Gunakarma of Shirisha

Botanical name: Albizia lebbeck

Family: Mimosoideae

Rasa	Tikta (bitter) Kashaya (astringent) Madhura (sweet) Katu (pungent)
Guna	Laghu (light) Teekshna (sharp) Rooksha (dry)

Virya	Seta (cold)
Vipaka	Katu (pungent)
Prabhava	Tridoshaa samana (pacifies vata, pitta and kapha) Vishaghna (against visha)

Indications: All visha conditions, skin diseases.

Mode of administration: Internal and external.

Shirisha due to its prabhava is most effective against visha.

Another reference

समूलपुष्पाङ्कुरवल्कबीजात् ।

क्वाथः शिरिषात् त्रिकटुप्रगाढः ॥

सलावणः क्षौद्रयुतोऽथ पीतो ।

विशेषतः कीटविषं निहन्ति ॥ (Su. Ka. 5/81)

The roots, flowers, leaf buds, bark and seeds of *shirisha* made as decoction and added with more quantity of *trikatu*, drugs of salt groups and honey and consumed internally destroy the poison of insect bite.

8.6 Vishaghna Mahakashaya (Charaka Samhita)

हरिद्रा मञ्जिष्ठा सुवहा सूक्ष्मैला पालिन्दीचन्दन

कतक शिरिष सिन्धुवार श्लेष्मातक इति दशेमानि
विषघ्नानि भवन्ति । (Cha.Su. 4/9)

Ingredients	Botanical name	Family	Karma
Haridra	Curcuma longa	Zingiberaceae	Kaphavata samana
Manjishtha	Rubia cordifolia	Rubiaceae	Kaphapitta samana
Suvaha	Pluchea lanceolata	Compositae	Kaphavata samana
Ela	Elettaria cardomum	Zingiberaceae	Tridoshahara
Palindi	Operculina turpethum	Convolvulaceae	Kaphapitta shodhana
Chandana	Santalum album	Santalaceae	Kaphapitta samana
Kataka	Strychnos potatorum	Loganiaceae	Vaata samana
Shirisha	Albizzia lebbeck	Leguminosae	Tridoshasamana
Sindhuvara	Vitex negundo	Verbenaceae	Kaphavata samana
Shleshmataka	Cordia dichotoma	Boraginaceae	Vata pitta samana

Guna Karma of Gana

Drug	Rasa	Guna	Veerya	Vipaka
Haridra	Katu (pungent) Tikta (bitter)	Ruksha (dry)	Ushna (hot)	Katu (pungent)
Manjishtha	Madhura (sweet) Tikta (bitter) Kashaya (astringent)	Guru (heavy) Ruksha (dry)	Ushna (hot)	Katu (pungent)
Suvaha	Tikta (bitter)	Guru (heavy)	Ushna (hot)	Katu (pungent)
Ela	Katu (pungent) Madhura (sweet)	Laghu (light)	Shita (cold)	Katu (pungent)
Palindi	Madhura (sweet) Tikta (bitter) Katu (pungent) Kashaya (astringent)	Laghu (light) Ruksha (dry) Tikshna (sharp)	Ushna (hot)	Katu (pungent)
Chandana	Tikta (bitter) Madhura (sweet)	Guru (heavy) Ruksha (dry)	Shita (cold)	Katu (pungent)
Kataka	Madhura (sweet) Tikta (bitter) Kashaya (astringent)	Laghu (light) Vishada (non-slimy)	Shita (cold)	Madhura (sweet)
Shirisha	Tikta (bitter) Kashaya (astringent) Madhura (sweet) Katu (pungent)	Laghu (light) Tikshna (sharp) Ruksha (dry)	Shita (cold)	Katu (pungent)
Sindhuvara	Katu (pungent) Tikta (bitter) Kashaya (astringent)	Laghu (light)	Ushna (hot)	Katu (pungent)
Shleshmataka	Tikta (bitter) Kashaya (astringent) Madhura (sweet-fruits)	Guru (heavy) Snigdha (unctuous)	Shita (cold)	Katu (pungent)

Research updates of Ingredients of Vishaghna Mahakashaya

Ingredients	Active principle	Effects
Haridra	Curcumin, turmeric oil	Anti-inflammatory, antioxidant, anti-diabetic, cardio and hepato protective, antihistaminic, blood purifier, phytonutrient, immune-modulator.
Manjishtha	Alizarin, psedoparapurins, rubia-din, parpurin and manjishtin	Antimicrobial, blood purifier, antioxidant, astringent.
Suvaha	Protein, quecetine, pluchine	Anti-inflammatory, anodyne, anti-psoriatic.
Ela	Cineol, terpeneol, limonene,	Antimicrobial, antiseptic, carminative, antispasmodic, effective against insect bite and mild poisons, antitoxic.
Palindi	Turpethine	Anti-inflammatory, anti-helminthic, purgative, carminative, antihistaminic, anti-snake bite and in scorpion bite.
Chandana	Santalol, alpha and beta curcumine, beta farnesene	Diuretic, antiseptic, cooling, bacteriostatic, antitoxic, deodorant, tonic.

Ingredients	Active principle	Effects
Kataka	Brucine in little amount	Anti-diabetic, anti-oxidant, antimicrobial, anti-inflammatory, anti-arthritis.
Shirisha	Saponins and tannins	Antiseptic, antibacterial, anti-allergic, wound healer, anti-toxic.
Sindhuvara	Organic acids, malic acids, traces of alkaloids and essential oil	Anti-inflammatory, antioxidant, astringent, anti-diarrhoeal, insecticidal, antiseptic.
Shleshmataka	Tannin	Diuretic, anti-helminthic, antimicrobial, anti-inflammatory, demulcent.

Indication: All visha conditions.

Mode of Administration: Internal and external.

Reference: Ayurvedic and contemporary aspect of vishaghna action of vishaghna-mahakashaya; a compiled review.

Published in world Journal of Pharmaceutical and Medical research.

8.7 Ekasara Gana (Sushruta Samhita)

सोमराजीफलं पुष्पं कटभी सिन्धुवारकः ।

चोरको वरुणः कुष्ठं सर्पगन्धा सप्तला ॥

पुनर्नवा शिरीषस्य पुष्पमारग्वार्धकजम् ।

श्यामम्बुष्ठा विडङ्गानि तथाऽप्राश्मन्तकानि च ।

भूमी कुरबकश्चैव गण एकऽस्मर स्मृतः ।

एकशो द्वित्रिशो वाऽपि प्रयोक्तव्यो विषापहः ॥

(Su.Ka.5/84-85)

Fruits and flowers of somaraji (bakuchi), katabhi, sinduvaraka, coraka, varuna, kushta, sarpagandha, saptala, punarnava, flowers of sireesha, aswagandha and arka, syama ambashta, vidanga, amra, asmantaka, bhumi and kurabaka these together known as Ekasara gana (group of drugs), and used single or two or three, to destroy poison.

Ingredients	Botanical name	Parts used	Karma
Bakuchi (Somaraji)	Celastrus paniculatus	Bark	Vranahara (ulcer healing), visarpahara.
Katabhi	Vita nigundo	Leaf	Vishaghna (anti-toxic) krimighna (antihelminthic).
Nirgundi	Psoralea corylifolia	Seed	Kushtanghna (agaist skin diseases), krimighna (antimicrobial).
Varuna	Crataeva nurvala	Stem bark	Krimihara (antimicrobial), hrudya (cardioprotective), raktashodhana (blood purifying)
Kushtha	Saussurea lappa	Root	Kushtahara (agaist skin diseases), visarpahara.
Sarpagandha	Rauvolfia serpentine	Root	Vranahara, krimighna, vishaghna
Saptala	Acacia concinna	Bark	Kandughna, twak vikara,
Punarnava	Boerhavia diffusa	Leaf	Vranahara, krimighna, vishaghna
Shirisha-pushpa	Albizia lebbeck	Stem bark	Visarpahara, vishaghna
Aragvatha	Cassia fistula	Fruit pulp	Hrudya, jwaraghna
Shyama	Operculina turpethum	Root bark	Krimihara, hrudya
Arka	Calotropis gigantea	Latex	Krimihara, vranahara
Ambasta	Cissampelos pareirs	Root	Vishaghna, hrudya, krumighna, garavisha nasa.

Ingredients	Botanical name	Parts used	Karma
Vidanga	Embelia ribes	Fruit	Krimihara
Asmantaka	Ficus rumphii	Stem bark	Vishaghna, daha samana
Bhumi Krishnamrit	—	—	—
Kurabaka	Barleria prionitis	Bark	Used in Kushtha, kandughna
Choraka	Angelica glauca	Root	Hridya, sanmjasthapana
Amra	Mangifera indica	Seed	Chardhighna

Drug	Rasa	Guna	Virya	Vipaka
Katabhi	Katu (pungent) Tikta (bitter)	Laghu (light) Ruksha (dry)	Ushna (hot)	Katu (pungent)
Nirgundi	Tikta (bitter) Katu (pungent)	Laghu (light) Ruksha (dry)	Ushna (hot)	Katu (pungent)
Bakuchi	Katu (pungent) Tikta (bitter)	Laghu (light) Ruksha (dry)	Ushna (hot)	Katu (pungent)
Varuna	Kashaya (astringent) Tikta (bitter)	Laghu (light)	Shita (cold)	Katu (pungent)
Kushtha	Tikta (bitter) Madhura (sweet)	Laghu (light) Ruksha (dry)	Ushna (hot)	Katu (pungent)
Sarpagandha	Tikta (bitter)	Laghu (light)	Shita (cold)	Katu (pungent)
Saptala	Tikta (bitter)	Laghu (light)	Shita (cold)	Katu (pungent)
Punarnava	Tikta (bitter) Madhura (sweet)	Laghu (light) Ruksha (dry)	Ushna (hot)	Katu (pungent)
Shirisha	Kashaya (astringent) Tikta (bitter)	Laghu (light)	Shita (cold)	Katu (pungent)
Aragvatha	Madhura (sweet)	Mridu (soft) Snigdha (unctuous)	Shita (cold)	Madhura (sweet)
Shyama	Tikta (bitter) Katu (pungent)	Laghu (light)	Shita (cold)	Katu (pungent)
Arka	Katu (pungent) Tikta (bitter)	Laghu (light) Ruksha (dry)	Ushna (hot)	Katu (pungent)
Ambashta	Tikta (bitter)	Laghu (light)	Ushna (hot)	Katu (pungent)
Vidanga	Kashaya (astringent) Tikta (bitter)	Laghu (light)	Ushna (hot)	Katu (pungent)
Asmantaka	Kashaya (astringent)	Laghu (light)	Shita (cold)	Katu (pungent)
Bhumi	—	—	—	—
Kurabaka	Tikta (bitter) Madhura (sweet)	Laghu (light)	Ushna (hot)	Katu (pungent)
Choraka	Katu (pungent) Tikta (bitter)	Laghu (light)	Ushna (hot)	Katu (pungent)
Amra	Kashaya (astringent)	Laghu (light)	Shita (cold)	Madhura (sweet)

This **ekasara gana** is used in the treatment of visha under sarpadmshta visha chikitsa. In this group of drugs, 18 drugs are plant origin and one is krishnamrittika (indicated in sarpa damsas as application). Seven ingredients are having shita virya and twelve drugs are ushna virya drugs. Most of the drugs are proven as antitoxic which counteract the effect of poison, with its

kaphapitta samana properties. Researches proved *nirgundi* as anti-inflammatory, antioxidant, and antimicrobial properties, *punarnava* is proved as hepato-protective and *bakuchi* is antimicrobial.

The mode of administration has not been mentioned; so it can be used according to the symptoms and the condition of the patient.

Indication: All visha, especially sarpa visha.

Summary

Dushivishari Agada

Ingredients: Pippali, dhyamaka, mamsi, rodhra, ela, suvarchika, kutannata, nata, kushtha, yashti, chandana and gairika.

Anupana: Madhu (honey) in dushi visha, dadhi or madhu in pakvashaya gata visha

Matra/dose: Gutika matra (1 karsha) in dushi visha, aksha pramana in pakvashaya gata visha.

Indication: Dushivisha, pakvashaya gatavisha.

Vilwadi Agada

Ingredients: Vilwa mulam, surasa pushpa, karanja phala, nata, surahva, triphala, vyosha, haridra, daruharidra, trikatu.

Dose: Internally 2000 mg/day in divided dosage.

Indications: Sarpa damsha (snake bite), lutha visha (spider poison), unduru visha (rat poison), vrishchika visha (scorpion poisoning), visuchika (cholera), ajirna (indigestion), gara visha (combination of poisons), jwara (rise in temperature) bhuta bhadua (infectious conditions).

Methods of Administration: Anjana (collyrium), paana (internal administration), nasya (nasal instillation).

Dashanga Agada

Ingredients: Vacha, hingu, vidanga, saindhava, gajapippali, pata, prativisha, vyosha (sunti, maricha, pippali).

Dose: As per the preparation, if it is made in the gutika form the dose is 1 karsha.

Indications: Sarva kita visha, it relieves the toxic effects of insect bite.

Mode of Administration: Internal

Murvadi Agada

Ingredients: Murva, amrita, nata, kana (pippali), patoli, chavya, chithraka, vacha, mustha, vidanga.

Indications: garauopahata pavaka (vitiated vata due to gara visha)

Dose: As churna matra (1 karsha).

Pancha Shirisha agada

The five parts of Shirisha

- | | |
|--|-----------|
| 1. Phala | 3. Twak |
| 2. Mula | 4. Pushpa |
| 5. Patra---are said to be the Shreshtha among vishahara aushadhas. | |

Vishaghna Mahakashaya

- | | |
|--------------|------------------|
| 1. Haridra | 6. Chandana |
| 2. Manjishta | 7. Kataka |
| 3. Suvaha | 8. Shirisha |
| 4. Ela | 9. Sindhuvara |
| 5. Palindi | 10. Shleshmataka |

Indications: All visha

Ekasara gana

Katabhi, Nirgundi, Bakuchi, Varuna, Kushtha, Sarpagandha, Saptala, Punarnava,

Shirisha, Aragavatha, Shyama, Arka, Ambashta, Vidanga, Asmantaka, Bhumi, Kurabaka, Choraka, amra.

The mode of administration has not been mentioned so can be used according to the symptoms and the condition of the patient.

Important Questions MCQ

1. The yoga said by Kashyapa
 - a. Dushi vishari agada
 - b. Vilwadi agada
 - c. Dashanga agada
 - d. Murvadi churna
2. The yoga is effective against jwara is
 - a. Dushi vishari agada
 - b. Vilwadi agada
 - c. Dashanga agda
 - d. Murvadi churna
3. The mode of administration of vilwadi gulika except

a. Anjana	c. Nasya
b. Pana	d. Dhuma
4. The vitiated agni due to gara is corrected by
 - a. Dushi vishari agada
 - b. Vilwadi agada
 - c. Dashanga agda
 - d. Murvadi churna
5. Vishaghna mahakashaya reference
 - a. Charaka samhita vimana
 - b. Charaka samhita Sutrasthana
 - c. Sushruta samhita kalpasthana
 - d. Charaka samhita chikitsa sthana

Answer key

1. c	2. b	3. d	4. d	5. b
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Learning Objectives

- Describe the therapeutic utility of Dushi vishari agada, Vilwadi agada, Dasanga agada, Murvadi agada and Panchashirisha agada.
- Enlist and discuss the ingredients of Vishaghna Mahakashaya and Ekasara gana.

Important SAQ

- Explain the practical utility of Agada formulation.
- Explain the application of various Agada formulations in skin diseases.
- Explain a yoga indicated for Keeta visha.
- Explain Viwadi gulika and its various uses in Agadatantra.
- Explain dooshivisha chikitsa and one indicated formulation.

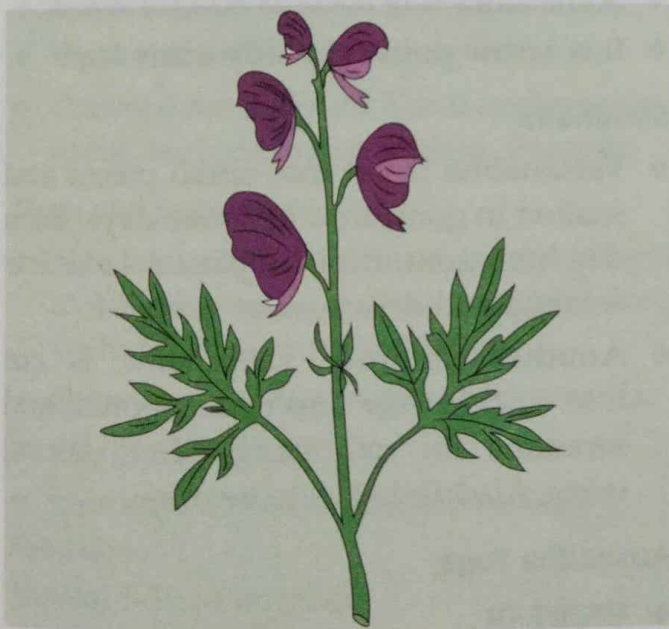
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Sthavara Visha – Poisons of Plant Origin

9.1 Cardiac Poisons: Vatsanabha, Karaveera, Digitalis, Tobacco and Cerbera Odollam

Cardiac poisons are the substances that specifically affect the heart, often leading to cardiac toxicity or cardiac dysfunctions.

Vatsanabha/Aconite



Vatsanabha or Visha

- ❖ **Type of poison:** Cardiac poison
- ❖ **Botanical name:** Aconitum ferox
 - Aconitum ferox – Indian aconite
 - Aconitum nepellus – European aconite

- ❖ **Family:** Ranunculaceae
- ❖ **Synonyms:** Vatsanabha, Amurtha, Visha, Garala.
- ❖ **Toxic part:** All parts are poisonous **mainly root** (usually mistaken as horseradish)



Rasapanchaka

- ❖ **Rasa:** Madhura
- ❖ **Guna:** Rukshna, Laghu, Thikshna
- ❖ **Virya:** Ushna
- ❖ **Vipaka:** Katu
- ❖ **Toxic principles:** Aconitine, hypaconitine, mesaconitine, Pseudo aconitine, Aconine, Picraconitine.

Mode of Action

Toxicity of aconite and related alkaloids are due to their action on voltage sensitive,

sodium channels of cell membranes of excitable tissues.

Aconitine first stimulates and then causes paralysis of the peripheral terminations of sensory and secretory nerves, CNS, and nerves of Myocardium, Skeletal and Smooth muscles. It does not affect the higher centers of the brain as consciousness remains intact till end.

Signs and Symptoms

GIT	Bitter sweet taste in the mouth, intensive burning pain on lips, mouth and throat, salivation, dysphagia, vomiting, pain in abdomen, gradual feeling of anaesthesia and numbness.
CVS	Hypotension, chest pain, palpitation, bradycardia, sinus tachycardia and feeble slow irregular pulse.
CNS	Vertigo, Restlessness, Headache, Giddiness.
MS	Weakness of the muscles of limbs with twitching and spasms.
RS	Respiration becomes slow, laboured and shallow.
Ocular	Pupils alternately contract and dilate.

Fatal dose

- ❖ 1-2 Gms root
- ❖ 2-5 Mg of pure Aconitine

Fatal period

- ❖ 2-6 hours

Treatments

There is specific antidote for aconite and treatment is supportive.

- ❖ Gastric lavage with warm water, milk and tannic acid.
- ❖ Multiple dose of activated charcoal.
- ❖ Atropine ½ mg-1mg IV for bradycardia.
- ❖ Symptomatic treatment.

PM Appearance

- ❖ Usually unidentified.
- ❖ Fragments of roots in stomach contents.
- ❖ Inflamed mucus membrane of stomach and small intestine.
- ❖ Frothy mucus in tracheo - bronchial tree.
- ❖ Necrosis of myocardium.
- ❖ Aconitine is quiet unstable and destroyed by putrefaction.

Medico-legal Importance

- ❖ It is ideal homicidal poison.
- ❖ As it is cheap and easily available, lethal dose is small. Fatal period is short. It is extremely unstable and destroyed by putrefaction. Hence, it cannot be detected by chemical analysis.
- ❖ Accidental poisoning is common as it is mistaken for Horse radish. It may be used by quacks for remedies.
- ❖ Sometimes it is used as Abortifacient.
- ❖ It is arrow poison in hilly areas.

Shodhana

- ❖ Vatsanabha is cut into small pieces and soaked in gomuthra for three days. Each day fresh gomuthra is replaced. Later it is washed and dried under sunlight.
- ❖ **Another method:** Vatsanabha is cut into small pieces and tied in pottali and swedana for one yama (three hours) using Ajadugda has to be done.

Aushadha Yoga

- ❖ मृत्युञ्जय रस
- ❖ आनन्द भैरव रस
- ❖ सञ्जीवनी वटि
- ❖ त्रिभुवन कीर्ति रस

Therapeutic dose

1/16 – 1/8 ratti (1 ratti = 120 mg)

Karaveera/Oleander



- ❖ **B.N:** Nerium indicum
(Cerbera thevetia – yellow oleander)
- ❖ **Family:** Apocyanaceae
- ❖ **Synonyms:** करवीर, हयारि, हयमार, अश्वमार
- ❖ **Toxic parts:** All parts are poisonous, especially seeds, stems, root and leaves.

Rasa Panchaka

- ❖ **Rasa:** Katu tikta
- ❖ **Guna:** Laghu ruksha tikshna
- ❖ **Virya:** Ushna
- ❖ **Vipaka:** Katu
- ❖ **Chemical constituents:** Cardiac glycosides, nerin, neriodorin, oleandrin, thevetin.

Signs and Symptoms

- ❖ Nausea, vomiting, salivation, dysphagia, dysarthria, acute abdominal pain along with diarrhoea, pupils dilated.
- ❖ Decreased BP, Ventricular tachycardia.
- ❖ Fibrillation AV block.
- ❖ Death results from cardiac failure.

Fatal dose

Leaves: 5-15 in number.

Roots: 15 – 20 gm.

Treatments

- ❖ Decontamination – Stomach wash, Catharsis.
- ❖ ECG monitoring.
- ❖ Correction of fluid Electrolyte balance.

Forensic Importance

- ❖ **Suicidal poison** – Due to easy availability, (usually decoction of root is made)
- ❖ **Accidental poisoning** may also occur.
- ❖ Used as an **Abortifacient**.
- ❖ Also used as a **cattle poison**.

Shodhana

Boiled in dolayantra filled with godugdha for one prahara.

Yogas

- ❖ करवीराध्यतैल
- ❖ कासीसादि तैलम्

Hritpatra/Digitalis



- ❖ **Type of poison:** Cardiac Poison
- ❖ **Botanical name:** Digitalis purpurea
- ❖ **Family:** Scrophulariaceae
- ❖ **Toxic part:** Whole plant is poisonous leaves are more poisonous.

Rasa Panchaka

- ❖ **Rasa:** Tikta
- ❖ **Guna:** Laghu ruksha

- ❖ **Virya:** Ushna
- ❖ **Vipaka:** Katu
- ❖ **Prabhava:** Hridya
- ❖ **Active principles:** Digitoxin, Digitalin, Digoxin.

Signs and Symptoms

- Burning sensation
- Bitter taste
- Dryness of throat
- Numbness of tongue
- Nausea
- Vomiting followed by abdominal pain and watery diarrhoea.

CNS

- ❖ Severe headache
- ❖ Fainting
- ❖ Muscle twitching

CVS

- ❖ Bradycardia
- ❖ Arrhythmia
- ❖ Ventricular tachycardia
- ❖ AV, SA, node block

Fatal dose

- ❖ **Digitalin:** 15–30 mg
- ❖ **Digitoxin:** 4 mg

Fatal period : 24 hours

Treatment

- ❖ **Stomach wash:** Tannic acid
- ❖ **Bowel:** Evacuated
- ❖ **Bradycardia:** Atropine should administered.

PM appearance

Inflamed GIT mucosa

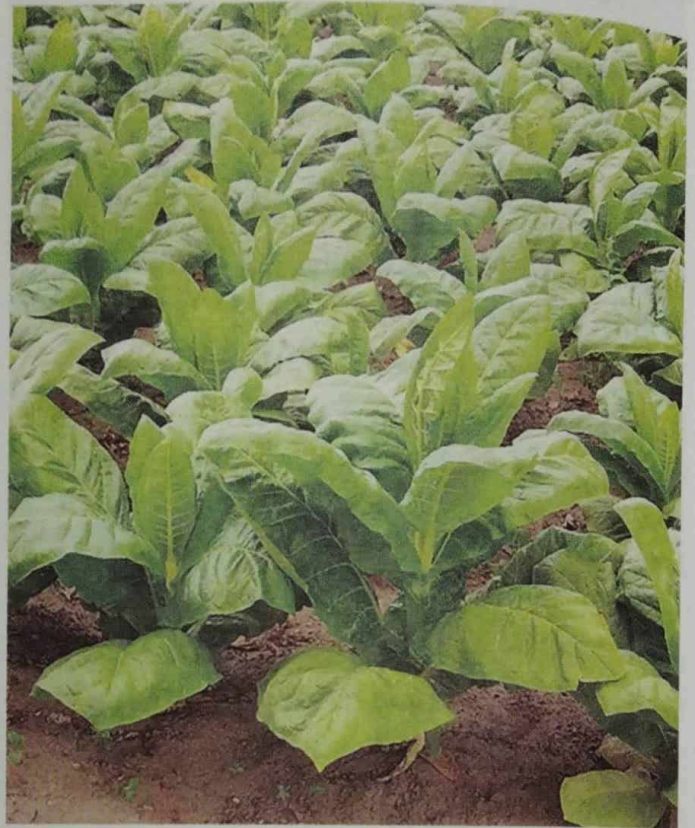
Seeds or fragments of leaves may be found in the stomach.

Medico-legal Aspects

Mostly: Accidental

Rarely: Homicidal

Tobacco/Tamraparni



- ❖ **Type of poison:** Cardiac poison
- ❖ **Botanical name:** Nicotiana tobacum
- ❖ **Family:** Solanaceae
- ❖ **Synonyms:** ताम्रपर्णि
- ❖ **Toxic part:** All parts except ripe seeds are poisonous.

Tobacco is the dried leaf

Active principle: Nicotine, Nor-nicotine



Rasa Panchaka

- ❖ **Rasa:** Katu tikta
- ❖ **Guna:** Laghu ruksha
- ❖ **Virya:** Ushna
- ❖ **Vipaka:** Katu

Clinical Features

Acute poisoning

- ❖ Salivation
- ❖ Nausea, vomiting, diarrhoea
- ❖ Characteristic odour is perceived in the breath.
- ❖ Vertigo
- ❖ Headache
- ❖ Sweating
- ❖ Confusion
- ❖ Ataxia
- ❖ Convulsions
- ❖ Hypertension
- ❖ Tachycardia

Chronic Poisoning

- ❖ Addiction to tobacco results in tremor
- ❖ Insomnia, anxiety, palpitations and headache.
- ❖ Bronchitis
- ❖ Oral and lung cancer
- ❖ Heart disease

Treatment

- ❖ Decontamination
- ❖ Cardiac monitoring
- ❖ Atropine for bradycardia and hypotension
- ❖ Diazepam for convulsions
- ❖ Supportive measure
- ❖ For chronic poisoning
- ❖ Withdrawal of tobacco use
- ❖ Tapered therapy
- ❖ Psychological counselling (to reduce the usage over time)

Fatal dose

- ❖ **Tobacco:** 20 g
- ❖ **Nicotine:** 60 mg

PM Appearance

- ❖ Brownish froth from at mouth and nostrils
- ❖ Congestion of GI tract
- ❖ Odour of tobacco
- ❖ Dark coloured blood
- ❖ Pulmonary oedema

Forensic Importance

- ❖ Most causes of poisoning are suicidal arising from the use of pesticides as also from the abuse of tobacco.
- ❖ Tobacco is one of the commonest drug of abuse worldwide (smoking/chewing).
- ❖ Used for infanticide in certain parts of India.
- ❖ It resists putrefaction.

Cerbera Odollam



- ❖ **Type of poison:** Cardiac poison
- ❖ **Botanical Name:** Cerbera odollam
- ❖ **Family:** Apocyanaceae
- ❖ **Toxic part:** Seeds
- ❖ **Active principle:** Cerberin, Thevetin

Clinical Features

- ❖ GIT irritation and cardiac toxicity
- ❖ Bitter taste in the mouth, with nausea
- ❖ Vomiting, abdominal pain, diarrhoea
- ❖ Irregular respiration, general weakness, bradycardia, collapse and death

Fatal dose: One fruit

Fatal period: 1-2 days

Treatment

- ❖ Gastric lavage
- ❖ Symptomatic treatment
- ❖ Maintenance of cardiac output
- ❖ Treatment of arrhythmias and heart block

PM appearance

- ❖ Exaggerated folds in the mucus coat in his stomach
- ❖ Liver congested
- ❖ Duodenum is brick red in colour
- ❖ Irregular purple patch in the centre

Forensic Importance

Suicidal: Common (dowry related suicide)

Accidental: Children eat the fruit mistaken for edible one.

Homicidal: Powdered kernel may be added with alcohol.

9.2 Neurotoxic Poisons: Kupilu, Ahiphenā, Dhattura, Bhanga

Neurotoxic poisons are the substances that specifically target and damage nervous system. They can interfere with the transduction of nerve impulses, disrupt signaling between nerve cells, or directly damage nerve cells.

Kupilu/Strychnos

- ❖ **Botanical name:** *Strychnos nuxvomica*
- ❖ **Family:** Loganiaceae
- ❖ **Class of poison:** Spinal poison

- ❖ **Synonyms:** Kuchelaka, Vishatinduka, Vishamushti, Kupilu, Karaskara.
- ❖ **Commonly known as:** "Dog Buttons". Used as Rodenticide also for killing stray dogs.

Chemical Constituents

- ❖ **Strychnine:** Colourless, crystalline alkaloid. odourless
- ❖ **Brucine -**
- ❖ **Loganine**
- ❖ **Toxic part:** Crushed seeds. Discoid shaped, Greyish brown, an inch in diameter.

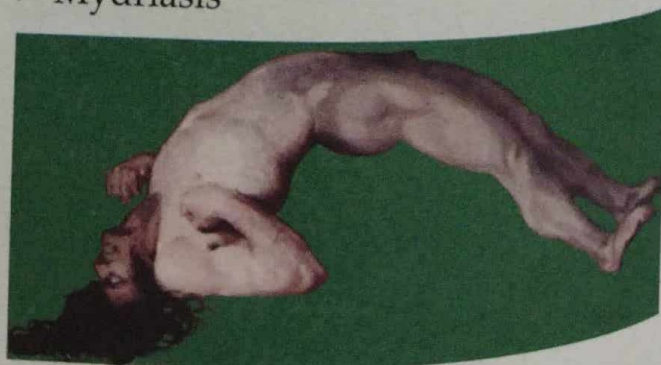
Rasa Panchaka

- ❖ **Rasa:** Tikta Katu
- ❖ **Guna:** Laghu ruksha tikshna
- ❖ **Virya:** Ushna
- ❖ **Vipaka:** Katu

Mode of Action: It inhibits neuro-transmitter glycine at post synaptic spinal cord motor neuron.

Clinical Features

- ❖ Anxiety
- ❖ Nausea
- ❖ Muscle twitching
- ❖ Convulsions
- ❖ Opisthotonus (Spasmodic Hyperextension of spine).
- ❖ Trimus (lock – jaw)
- ❖ Risus sardonicus (Spasm of facial muscles produces grimace like look).
- ❖ Emprosthotonus (Forward bending) - less common.
- ❖ Pleurosthotonus (Lateral bending)
- ❖ Mydriasis



opisthotonus (backward bending).

Complications: Hyperthermia, Rhabdomyolysis, Myoglobinuria, Renal failure, Respiratory failure.

Consciousness retained till death results in agonising death.

Differential diagnosis: Tetanus.

	Tetanus	Strychnine Poisoning
History	Of Injury	Of Poisoning
Onset	Gradual	Sudden
Trismus	Early Feature	Late Feature
Involvement of muscles	Group of muscles affected at a time	All muscles affected simultaneously
Muscle rigidity	Sustained even b/w convulsions	Disappears b/w convulsion
Chemical analysis	Negative	Positive for poison

Fatal dose: 1-2 crushed seeds

15-30 mg of strychnine

Fatal period: 1-2 hours

Treatment

- ❖ Diazepam or barbiturates for convulsions
- ❖ Oxygen assisted ventilation
- ❖ Decontamination measures (Stomach wash)
- ❖ Activated charcoal
- ❖ Acidification of urine enhances Strychnine elimination.

PM – Appearance

- ❖ Post-mortem caloricity – Rise of body temperature after death instead of decline.
- ❖ Early onset and disappearance of rigor mortis.
- ❖ Asphyxial signs
- ❖ Congestion of GI tract

Forensic Importance

- ❖ Accidental ingestion by children.
- ❖ Suicidal cases rare due to agonising death.
- ❖ Homicidal cases have been reported.

Shodhana

विषतिन्दुक बीजानि विन्यसेत् गृहवारिणि ।

दिनत्रयम् प्रयत्नेन त्वपनीय बहिस्त्वचम् ॥

निदाघे चाथ संशोष्य चूर्णये भिषजाम् वर ।

एव विशुद्धमायाति सर्वथा विषतिन्दुकम् ॥

(R.T. 24/72-73)

Seeds soaked in Kanji for Three days – Skin of seeds separated – Dried in sunlight – Powdered.

Aushadha yoga

- ❖ अग्नितुण्डि रस
- ❖ लक्ष्म विलास रस
- ❖ विषगर्भ तैल
- ❖ विषतिन्दुक तैल

Therapeutic Dose: ¼ -1 Gunja

Amayiga Prayoga

Alarka visha: Administering Kupilu bija churna for 1 month.

Vrana: Apply paste of Kupilu patra on dushtavrana.

Ahiphena



- ❖ **B.N.:** *Papaver somniferum* - Papaveraceae
- ❖ **Class of poison:** Somniferous/Narcotic
- ❖ **English names:** Opium poppy
- ❖ **Synonyms:** Ahiphena, nagaphena, aphenā
- ❖ **Toxic part:** Latex/फलनिर्यास

Chemical Constituents

2 groups

Phenanthrene group	Benzylisoquinoline group
Morphine	Papaverine
Codeine	Noscapine (narcotine)
Thebaine	

Rasa Panchaka

- ❖ **Rasa:** Tikta Kashaya
- ❖ **Guna:** Sukshma, ruksha, vyavayi
- ❖ **Virya:** Ushna
- ❖ **Vipaka:** Katu
- ❖ **Prabhava:** Madaka

Clinical Features



Acute Poisoning

❖ **First stage:** Excitement

- This stage is very short or absent in large dose is taken.
- Euphoria, excitement, talkativeness, flushing of face, hallucination, restlessness.

❖ **Second stage:** Stupor

- Initially drowsiness, giddiness, headache, itching sensation.
- Later uncontrollable desire of sleep, cyanosis, pupils are constricted.

❖ **Third stage:** Stage of narcosis (deep sleep) or coma stage—

- **Opium triads:** Coma, Pinpoint Pupil, Respiratory Depression.
- **Pinpoint pupil (miosis):** pupils are contracted they do not respond to light, this is characteristic. Pupil dilate at the end.
- **Respiratory depression:** RR depressed, non-cardiogenic pulmonary oedema, decreased pulse, BP, RR, temperature.
- **Coma** with all reflexes lost.

Chronic Poisoning/Morphinism

- ❖ Unusual mood swings: Depression with euphoria.
- ❖ Withdrawal from family life and social life.
- ❖ Frequent conflict with law (Driving offences).
- ❖ Presence of pills/syringes, nearby bloody swabs.
- ❖ Periodic disappearance into a locked room.
- ❖ Pinpoint Pupil
- ❖ Anorexia, Weight loss and Pallor
- ❖ Chronic constipation
- ❖ Sweating tremors

- ❖ Also Dermal scars, Amnesia, Confusions and Hallucinations.

Fatal Dose

	Fatal Dose	Therapeutic dose
Morphine	200 mg	10-15 mg
Codeine	800 mg	10-60 mg
Heroin	50 mg	

Treatment**Acute Poisoning**

- ❖ Supportive care
- ❖ Airway protection and Breathing.
- ❖ **Naloxone** – Antidote of choice of opium poisoning.
- ❖ Convulsions may be treated using Benzodiazepines.

Chronic Poisoning /Morphinism

- ❖ Gradual withdrawal of the Opiate.
- ❖ Antispasmodics for abdominal cramps associated with vomiting and diarrhoea.
- ❖ Tranquillisers or bedtime sedation if necessary.
- ❖ Psychiatric counselling.

PM Appearance

- ❖ Injection marks Dermal abscesses, scarring.
Main areas – Antecubital fossa, forerarm, neck, groin, ankles.
- ❖ Smell of opium while opens the chest.
- ❖ Tattooing
- ❖ Emaciation
- ❖ Gross pulmonary oedema with froth exuding out of mouth and nostrils.
- ❖ Cerebral Oedema
- ❖ Congestion of liver with enlargement of hepatic lymph nodes.

Forensic Importance

- ❖ Opiates are among the commonest of the drugs abused today in India.

- ❖ Accidental death occurs due to over dose.
- ❖ Suicidal death are also reported as it causes painless death.
- ❖ Homicidal cases are rare.

Shodhana

Ahiphena is mixed or dissolved in water – Then strained in a cloth – Then bhavana of Ahiphena with – 21 times with **ardraka swarasa**.

Therapeutic dose

¼ -1 ratti

Aushadha yogas

- ❖ अहिफेनासवम्
- ❖ निद्रोदयवटि
- ❖ महावातराज रस

Dhattura

- ❖ **BN:** Dhatura alba
- ❖ **Family:** Solanaceae
- ❖ **Synonyms:** Unmatta, kanaka, durdurpatra
- ❖ **Class of poison:** Deliriant type of cerebral poison.
- ❖ **English name:** Thorn apple
- ❖ **Toxic part:** Seeds
- ❖ **Toxic principles:** Hyoscine (scopolamine), Hyoscyamine, Atropine.

Rasa Panchaka

- ❖ **Rasa:** Tikta Katu
- ❖ **Guna:** Laghu, ruksha

- ❖ **Virya:** Ushna
- ❖ **Vipaka:** Katu
- ❖ **Karma:** Kaphavatahara, vishaghna, kasahara.

Signs and Symptoms

It makes apexes on and blind as bat, hot as hare, dry as bone, red as beet, mad as a wet hen.

Main signs and symptoms are mentioned in 9D's:

1. Dryness of mouth, nausea, vomiting
2. Dysphagia
3. Dilated pupil
4. Diplopia
5. Dry hot skin
6. Drunken gait/ataxia
7. Delirium with confusion, agitation and hallucination
8. Drowsiness leading to coma
9. Dysuria
10. Death due to respiratory failure or cardiac arrhythmias.

Fatal Dose

- ❖ 50-100 seeds
- ❖ 10-100 mg of atropine
- ❖ Fatal period-24 hours

Treatment

- ❖ Decontamination with emesis and stomach wash.
- ❖ Antidote – Physostigmine, Pilocarpine.
- ❖ Diazepam IV for sedation and seizures.
- ❖ Morphine should be avoided.

Post-mortem Appearances

Non-specific signs

Forensic Importance

1. **Accidental:** Ingestion of seeds by children
2. **Suicidal:** Mostly reported in rural areas
3. **Homicidal:** Rare

Stupefaction

It means an extract of seeds mixed with food (or tobacco), administer it to an unsuspecting victim to facilitate robbery or rape. It produces confusion, agitation, disorientation and loss of consciousness.

Rail road poison

Usually it is used as a stupefying by poison given to travellers in high way robbery or kidnapping. Hence, it is called an Rail road poison.

Also commonly mistaken chilli/capsicum seeds



S. No.	Features	Dhatura	Capsicum seeds
1.	Size	Large & thick	Small and thin
2.	Shape	Kidney shaped	Round
3.	Surface	Tiny depression	Smooth
4.	Odour	Odourless	Pungent
5.	Taste	Slightly bitter	Pungent

Shodhana

- ❖ Swedana in Dolayantra using godugda for 3 hours.
- ❖ Later it is washed with hot water.
- ❖ Dry it and can be stored.

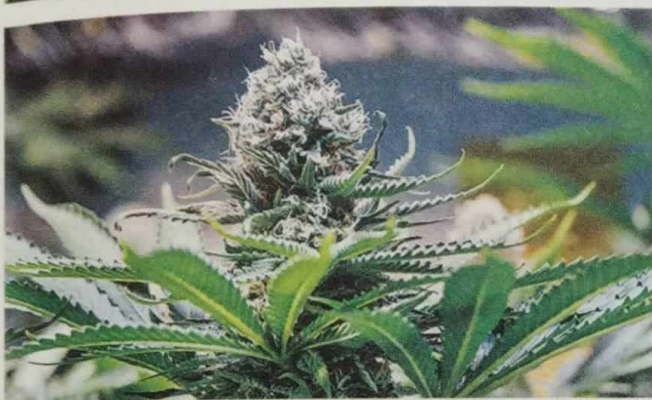
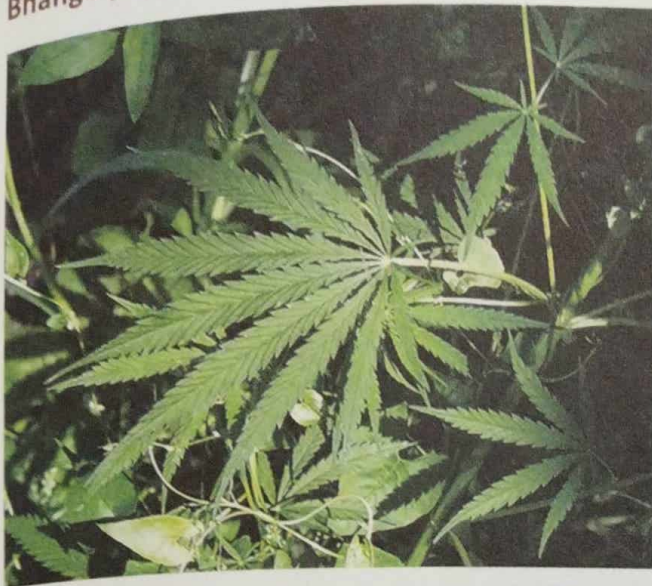
Aushadha Yoga

- ❖ कनकासव
- ❖ महाकनक तैल

Therapeutic dose

बीज चूर्ण - (1/4 - 1/2 gunja)

Bhanga (Vijaya)/Cannabis



- ❖ **Botanical name:** Cannabis sativa / indica
 - ❖ **Family:** Cannabinaeae
 - ❖ **Type of poison:** Deliriant poison
 - ❖ **Synonyms:** भङ्गः, मादिनि
 - ❖ **Toxic part:** All parts of the plants except stem, root, and seed of cannabis.
 - ❖ **Active principle:** Tetra hydrocannabinol (THC)
- Rasa Panchaka**
- ❖ **Rasa:** Tikta
 - ❖ **Guna:** Laghu, tikshna vyavayi
 - ❖ **Virya:** Ushna
 - ❖ **Vipaka:** Katu

Different Forms of Bhanga

Marijuana: Dried flowering tops, crushed and smoked in a pipe.

Hashisha (Charas): Dried resin of flowering tops.

Most potent cannabis preparation and contains (20-30%) THC.

Ganja: Resinous extract of leaves and bracts of female plant.

Bhanga: Dried leaves and stem made into a decoction.

Majun: Sweet meat prepared with plant extract.

Clinical Features

Acute Poisoning

- ❖ Euphoria with drowsiness and disorientation.
- ❖ Temporal and special disorientation with intensification of senses / colours become brighter, sounds become more distinct).
- ❖ Motor incoordination
- ❖ Stimulation of appetite
- ❖ Tachycardia, palpitation, hypotension
- ❖ Conjunctival congestion, miosis
- ❖ Characteristic burnt rope odour
- ❖ IV intake causes – headache, diplopia, vertigo, dyspnoea, hypotension, and renal failure.

Chronic Poisoning

- ❖ A motivational syndrome (is a chronic psychiatric disorder characterized by a variety of changes in personality, emotions and cognitive functions such as lack of activity, inward turning, apathy, inability to concentrate).
- ❖ Chronic abuses of cannabis gradually make a person lethargic, apathetic and no interest to work with poor concentration.

Hashish insanity

Chronic abusers of cannabis becomes paranoid, psychosis with violent behaviour culminating in homicide or suicide (Running smoke).

There is increased susceptibility of pharyngitis, bronchitis and asthma, gynaecomastia (in males).

Treatment

Acute Poisoning	Chronic Poisoning
Decontamination	Gradual withdrawal of the drug
Stomach wash	Diazepam for anxiety
Haloperidol	Antipsychotics for psychosis
Psychotherapy	

Forensic importance

Drug of Abuse

Fatal dose

- ❖ Charas – 2gm / kg of body weight
- ❖ Ganja - 8 gm /kg of body weight
- ❖ 10 gm /of body weight

PM Appearance

- ❖ No significance, but are those of asphyxia.

Shodhana

- ❖ Dried leaves of cannabis soaked in water.
- ❖ Dried
- ❖ Fried in ghee in manda-agni.

Aushadha Yoga

- ❖ मदनोदय मोदक
- ❖ त्रैलोक्य सम्मोहन रस

Therapeutic Dose

2-4 ratti

Amayika Prayoga

In Insomnia

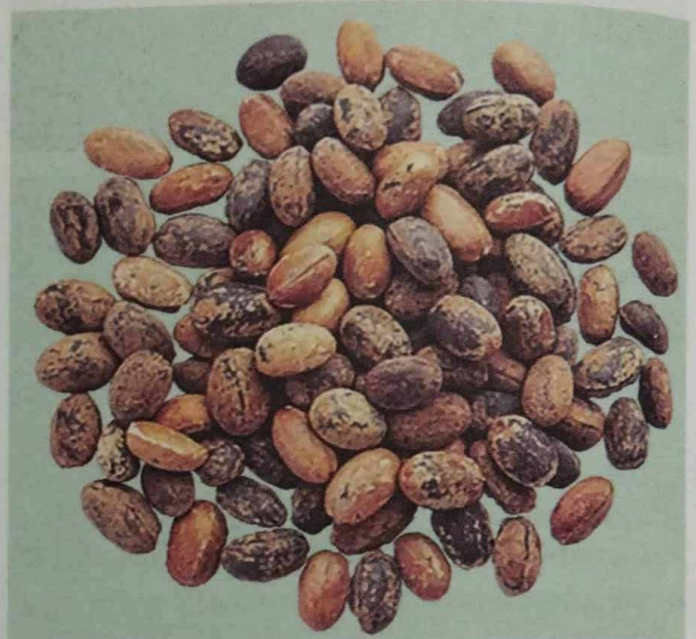
Leaves + goat milk - made into a paste for application on forehead.

9.3 Irritant Poisons: Jayapala, Gunja, Bhallataka, Arka, Snuhi, Langali

Irritant poisons are the substances that can cause irritation or damage to biological tissues upon contact. These substances typically act locally and can cause inflammation, pain and tissue damage at the site of contact.

Jayapala

- ❖ **BN:** Croton tiglium
- ❖ **Family:** Euphorbiaceae
- ❖ **Class of poison:** Irritant organic
- ❖ **Common name:** Jamalgota (Hindi)
- ❖ **Synonyms:** जेपाल, रेचक, मलद्रावि ।
- ❖ **Toxic part:** Seeds and oil.
- ❖ **Chemical constituent:** Crotin (Toxalbumen), Crotonoside (Glucoside).



Rasa Panchaka

- ❖ **Rasa:** Katu
- ❖ **Guna:** Guru, ruksha, tikshna
- ❖ **Virya:** Ushna
- ❖ **Vipaka:** Katu

Signs and Symptoms

- ❖ Hot burning pain in mouth, throat, up to abdomen.
- ❖ Salivation
- ❖ Nausea
- ❖ Vomiting
- ❖ Purging – Gripping pain bloody stool
- ❖ Tachycardia
- ❖ Vertigo
- ❖ Circulatory and respiratory collapse, death.

Fatal dose: 1-4 crushed seed (1-2 ml of oil)

Fatal period: 4-6 hours

Treatment

- ❖ Stomach wash with water and activated charcoal.
- ❖ Maintain fluid – Electrolyte balance
- ❖ Demulscent drinks like milk/Egg white
- ❖ Pain killers – Morphine

PM Appearance

- ❖ Red inflamed mucus membrane of stomach and intestine.
- ❖ Congested liver and spleen.
- ❖ Swollen and congested kidney.

Forensic Importance

- ❖ Commonly – Accidental poisoning.
- ❖ Suicidal and Homicidal cases are rare.
- ❖ It is taken internally as an Abortifacient.
- ❖ Oil is used as an arrow poison.

Shodhana

Jayapala: Remove outer skin and radicle after cutting it as two-potali is placed in Dolayantra swedana is done for 1 prahara using godugda–Repeat this procedure for 3 times.

Aushada Yoga

- ❖ इच्छाभेदि रस
- ❖ जलोदरारि रस

Therapeutic Dose

1/8-1/4 gunja

Gunja



❖ **B.N:** Abrus precatorius

❖ **Family:** Loganiaceae

❖ **Synonyms:** गुब्ज, रक्त, रक्तिक

❖ **Types of Poison:** Organic irritant

❖ **Common name:** Indian liquorice, rosary pea.

❖ **Toxic part:** Seeds

Toxic Principle

- ❖ Abrin – (toxalbumen)
- ❖ Abrine
- ❖ Abralin

Rasa Panchaka

- ❖ **Rasa:** Tikta, kashaya
- ❖ **Guna:** Laghu, ruksha, tikshna
- ❖ **Virya:** Ushna
- ❖ **Vipaka:** Katu

Clinical Features

Ingestion of seeds or extract can cause hemorrhagic gastritis with :

- ❖ Burning pain in mouth and throat
- ❖ Sever vomiting
- ❖ Abdominal pain
- ❖ Bloody diarrhoea
- ❖ Elevation of enzymes
- ❖ Cardiac arrhythmia
- ❖ Convulsions
- ❖ CNS depression
- ❖ Cerebral oedema
- ❖ Dermal contact: Redness, rash
- ❖ Ocular exposure – Reddening, swelling, blindness.

External Application/Remote

Preparation of Suis

Seeds of abrus alone or mixed with Dhatura, opium and onion, made into spikes or Sui, are then dried in sun.

When implanted as Sui or seed extract is injected parenterally, the person can develop symptoms resemble viper snake bite.

- ❖ Victim (animal/human) then becomes drowsy, unable to move, goes into coma, followed by death.
- ❖ Symptoms resemble those viper bite.

Fatal dose

- ❖ (90-120 g) mg by injection
- ❖ 1-2 crushed seeds by mouth

Fatal period: 3-5 days

Treatment

- ❖ Gastric lavage
- ❖ Activated charcoal
- ❖ Purgatives
- ❖ Dissecting out the Suis and injection anti-abrin.

PM Appearance

- ❖ The injured site is swollen, inflamed, necrosis.
- ❖ Fragments of sui are usually found in the wound.
- ❖ Internal organs are congested and haemorrhagic.
- ❖ Mucus membranes of the stomach and intestine is highly congested with numerous haemorrhagic patches on its surface.

Medico-legal Importance/Forensic importance

- ❖ Abortifacient
- ❖ Accidental poisoning is not uncommon among children who chew on the attractive seeds out of curiosity.
- ❖ Suis are common by used in rural India as cattle poison by injecting needles made out of dried seed paste.
- ❖ Homicides are also reported with Sui.

Shodhana

Gunja seeds are tied in a potali and do dolayantra swedana with kanji – for one yama or three hours.

Yoga

- ❖ गुञ्जाद्य तैल
- ❖ गुञ्जा जीवन रस
- ❖ गुञ्जाभद्र रस

Therapeutic dose

½ -1½ ratti

Bhallataka



- ❖ **Botanical name:** Semecarpus anacardium
- ❖ **Family:** Anacardiaceae
- ❖ **Class of Poison:** Organic irritant poison
- ❖ **Botanical name:** Semecarpus anacardium
- ❖ **English name:** Marking nut
- ❖ **Synonyms:** Arushkara, Agnika, Sopha krita.
- ❖ **Toxic part:** Ripened seed.

Chemical contents: semicarpol, bilwanol, anacardic acid.

Rasa Panchaka

- ❖ **Rasa:** Katu, tikta, kashaya
- ❖ **Guna:** Laghu, snigdha, tikshna
- ❖ **Virya:** Ushna
- ❖ **Vipaka:** Madhura

Clinical Features

- ❖ Skin contact with the juice results inflammation and vesication.
- ❖ Ingestion causes gastro-intestinal distress hypotension and Delirium.

Fatal dose: 10 gms

Fatal period: 12- 24 hours

Treatment

- ❖ Symptomatic treatment
- ❖ Do supportive care

PM Appearance

- ❖ Bruise like blisters are seen in contact area.
- ❖ Blisters are seen in mouth, throat, and stomach which are congested and inflamed.
- ❖ Stomach – congested – inflamed.
- ❖ Liver shows degenerative changes.

Forensic Importance

- ❖ Juice is used as an abortifacient
- ❖ Malingering: production of artificial bruise or conjunctivitis with the juice.
- ❖ Accidental poisons due to quackery.

Shodhana

इष्टिका चूर्ण संयुक्तं फलं भल्लतकोद्भवम्।

पोट्टलि मध्य निहितं घर्षयेत्तातिवेगयेत्॥

ततः प्रतप्ततोयेन क्षालयेत्ततिलतः।

इत्थं तैल त्वचाहीनं भल्लातकं शुद्धिमवाप्नुवेत्॥

Bhallataka fruits collected-rubbed with Ishtika churna. In a Pottali and Washed in hot water. Removal of skin and devoid of oil happens.

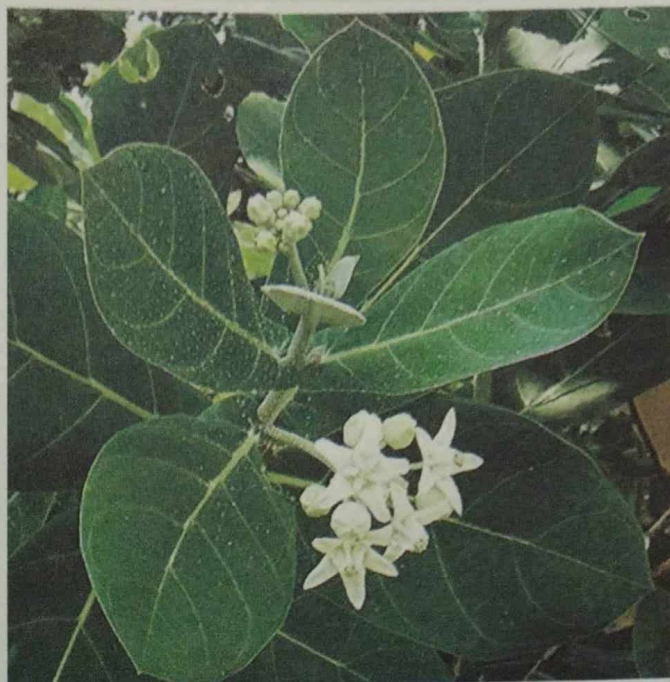
Yogas

- ❖ भल्लातक रसायन
- ❖ भल्लातकासव
- ❖ अमृत भल्लातक लेह

Therapeutic dose: 1.2-2 gm in kshirapaka form.

Arka

- ❖ **Type of Poison:** Organic Irritant
- ❖ **Botanical name:** Calotropis procera (white)
Calotropis gigantea (Purple).
- ❖ **Family:** Asclepiadaceae
- ❖ **Toxic part:** Milky juice (kshiram)
- ❖ **Chemical constituents:** Uscharin, Calotoxin, Calactin.



Rasa Panchaka

- ❖ **Rasa:** Katu tikta
- ❖ **Guna:** Laghu, ruksha, tikshna
- ❖ **Virya:** Ushna
- ❖ **Vipaka:** Katu

Clinical Features

- ❖ Vomiting
- ❖ Diarrhoea
- ❖ Mydriasis
- ❖ Convulsion
- ❖ Delirium
- ❖ Skin contact with the sap or other parts of the plant can causes inflammation and vesication of skin.
- ❖ Eye contact with the juice causes severe conjunctivitis.
- ❖ Contact with juice causes inflammation.

Treatment

- ❖ Gastric lavage
- ❖ Giving demulcents
- ❖ IV fluids
- ❖ Diazepam for convulsions
- ❖ Wash skin eyes exposure with soap and water.

Fatal dose: Uncertain

Fatal period: ½- 8 hours

Forensic Importance

- ❖ Juice is used as an Abortifacient
- ❖ Malingering – Artificial bruise, conjunctivitis with the juice.
- ❖ Cattle poison and used as an arrow Poison.
- ❖ Accidental poison also happens.

Method of Shodhana

Arka kshira is triturated with Chinchaa-pathra swarasa.

Aushada Yoga

- ❖ अर्क लवण
- ❖ अर्क तैल

Snuhi



- ❖ **Type of Poison:** Irritant poison
- ❖ **Botanical name:** Euphorbia neriifolia
- ❖ **Family:** Euphorbiaceae
- ❖ **Toxic part:** Acrid milky exudate
- ❖ **Chemical constituents:** Resin, Gums, Turpenes, Euphorbin, Nerifolin.

Rasa Panchaka

- ❖ **Rasa:** Katu
- ❖ **Guna:** Snigdha, tikshna.
- ❖ **Virya:** Ushna
- ❖ **Vipaka:** Katu
- ❖ **Fatal dose:** 125–250 mg of drug in powder form.

Clinical Features

❖ External

When applied to skin produces vesication. When dropped into eye it produces inflammation and may affect the eye sight.

❖ Internal

Acts as irritant causing vomiting, diarrhoea, convulsions, coma.

❖ Fatal dose

125 – 250 mg – Dried powder (API)
Fatal period – 3 days

Treatment

Stomach wash, Administration of drugs indicated by symptoms.

PM Appearance

No specific signs

Medico-legal Importance

- ❖ Criminal abortion
- ❖ Rarely used for homicidal purposes. Juice is poured into eyes for infidelity.
- ❖ Accidental – not common

Shodhana

- ❖ 2 pala snuhi +2 tola chinchaa swarasa
- ❖ Vessel kept in sunlight
- ❖ Allow it to dry the water content.

Aushadha Yoga

- ❖ स्नुहि क्षीर घृत
- ❖ महा मरिच्यादि तैल
- ❖ Commonly used for तीक्ष्ण विरेचन

Langali



❖ **Type of Poison:** Organic irritant poison, Abortifacient.

❖ **Botanical name:** *Gloriosa superba*

❖ **Family:** Liliaceae

❖ **Toxic principles:** Colchicine, Superbine

Rasa Panchaka

❖ **Rasa:** Katu tikta

❖ **Guna:** Laghu, tikshna

❖ **Virya:** Ushna

❖ **Vipaka:** Katu

❖ **Fatal dose:** 0.75 gm

❖ **Fatal period:** Not specific

Signs and Symptoms

- ❖ Severe vomiting
- ❖ Diarrhoea
- ❖ Abdominal pain
- ❖ Hypotension
- ❖ Respiratory failure

More severe effects: Seizures, bone marrow suppression, ECG changes and death.

Treatments

- ❖ Decontamination – Activated charcoal.
- ❖ Symptomatic and supportive measures.
- ❖ Analgesic – Opiates
- ❖ Respiratory failure

Forensic Issues

- ❖ Used as abortifacient – as it is a uterine stimulants.
- ❖ Accidental poisoning may occur when the tuber of *Gloriosa superba* is mistaken for sweet potato.
- ❖ Suicidal cases are also reported.

Yoga

निर्गुण्ड्यादि तैलम्

कासीसादि तैलम्

Summary

Vatsanabha

❖ **Type of Poison:** Cardiac poison

❖ **Botanical name:** *Aconitum ferox*

• *Aconitum ferox* – Indian aconite

• *Aconitum nepellus* – European aconite

❖ **Family:** Ranunculaceae

❖ **Synonyms:** Vatsanabha, Amurta, Visha, Garala.

❖ **Toxic part:** All parts are poisonous mainly root (usually mistaken as horse radish).

❖ **Fatal dose:** 1-2 Gms root (2-5 Mg of pure Aconitine)

❖ **Fatal period:** 2-6 hours

Signs and Symptoms

- ❖ Immediate tingling and numbness over lips, mouth and tongue which extends to the whole body.
- ❖ Patient feels giddiness
- ❖ His vision and speech impaired
- ❖ Limbs become weak and becomes unsteady.
- ❖ Twitching of muscles and convulsions occurs.
- ❖ Pulse becomes slow and irregular.
- ❖ Breathing shallow and feeble.

PM Appearance

- ❖ Usually Unidentified.
- ❖ Fragments of Roots in stomach contents.
- ❖ Inflamed mucus membrane of stomach and small intestine.
- ❖ Frothy Mucus in tracheo - bronchial tree.
- ❖ Necrosis of Myocardium
- ❖ Aconitine is quiet unstable and destroyed by putrefaction.

Shodhana

Vatsanabha is cut into small pieces and soaked in gomutra for 3 days. Each day fresh gomutra is replaced. Later it is washed and dried under sunlight.

Karaveera/Oleander

- ❖ **B.N:** Nerium indicum (cerbera thevetia – yellow oleander)
- ❖ **Family:** Apocyanaceae
- ❖ **Toxic parts:** All parts are poisonous, specially seeds, stems, root.
- ❖ **Chemical Constituents:** Cardiac glycosides, nerin, neriodorin, oleandrin, thevetin.
- ❖ **Signs and Symptoms:** Nausea, vomiting, salivation, dysphagia, dysarthria, acute abdominal pain along with diarrhea, pupils dilated–
 - Decreased BP, Ventricular tachycardia
 - Fibrillation AV block
 - Death results from cardiac failure.

Fatal Dose

- ❖ **Leaves:** 5-15 in number
- ❖ **Roots:** 15 g – 20 gm

Forensic Importance

- ❖ **Suicidal:** poison – Due to easy availability, (usually decoction of Root is made).
- ❖ Accidental poisoning – may also occur.
- ❖ Used as an Abortifacient.
- ❖ Also used as a cattle poison.

- ❖ **Sodhana :** Boiling in Dolayantra filled with godugdha for 1 prahara.

Hritpatra/Digitalis

- ❖ **Type of Poison:** Cardiac Poison
- ❖ **Botanical name:** Digitalis purpura
- ❖ **Family:** Scophulariaceae
- ❖ **Toxic part:** Whole plant is poisonous leaves are more poisonous.

Fatal dose

- ❖ **Digitalin:** 15 – 30 mg
- ❖ **Digitoxin:** 4 mg

PM Appearance

- ❖ Inflamed GIT mucosa
- ❖ Seeds or fragments of leaves may be found in the stomach.

Tobacco/Tamraparni

- ❖ **Type of Poison:** Cardiac poison
- ❖ **Botanical name:** Nicotiana tobacum
- ❖ **Family:** Solanaceae
- ❖ **Toxic part:** All parts except ripe seeds are poisonous Tobacco is the dried leaf.
- ❖ **Active principle:** Nicotine, Nor-nicotine.

Chronic Poisoning**Addiction to Tobacco results in tremor**

- ❖ Insomnia, anxiety, palpitations, headache
- ❖ Bronchitis
- ❖ Oral and lung cancer
- ❖ Heart disease

Fatal Dose

- ❖ **Tobacco:** 20 g
- ❖ **Nicotine:** 60 mg PM appearance
- ❖ Brownish froth from at mouth and nostrils
- ❖ Congestion of GI tract
- ❖ Odour of tobacco
- ❖ Dark coloured blood

Cerberella Odollam

- ❖ **Type of Poison:** Cardiac poison
- ❖ **Botanical Name:** Cerbera odollam
- ❖ **Family:** Apocyanaceae
- ❖ **Toxic part:** Seeds
- ❖ **Active principle:** Cerberin, Thevetin
- ❖ **Fatal dose:** One fruit
- ❖ **Fatal period:** 1-2 days

PM Appearance

- ❖ Exaggerated folds in the mucus coat in his stomach.
- ❖ Liver congested
- ❖ Duodenum is brick red in color.
- ❖ Irregular purple patch in the center.

Neurotoxic Poisons**Kupilu/Strychnos**

- ❖ **Botanical name:** Strychnos nuxvomica
- ❖ **Family:** Loganiaceae
- ❖ **Class of poison:** Spinal poison
- ❖ **Synonyms:** Kuchelaka, Karaskara, Vishatinduka, Vishamushti, Kupilu.

Chemical Constituents

- ❖ Strychnine, brucine, loganine
- ❖ **Fatal dose:** 1-2 crushed seeds
- ❖ 15-30 mg of strychnine
- ❖ **Fatal period:** 1-2 hours

PM Appearance

- ❖ **Post-mortem calorificity** – Rise of body temperature after death instead of decline.
- ❖ Early onset and disappearance of rigor mortis.
- ❖ Asphyxial signs
- ❖ Congestion of GI tract

Ahiphena

- ❖ **B.N:** Papaver somniferum - Papaveraceae
- ❖ **Class of poison:** Somniferous/Narcotic
- ❖ **Toxic part:** Latex

Chronic Poisoning/Morphinism

- ❖ Unusual mood swings: depression with euphoria.
- ❖ Withdrawal from family life and social life.
- ❖ Frequent conflict with law (Driving offences).
- ❖ Presence of pills/Syringes nearby bloody swabs.
- ❖ Periodic disappearance into a locked room.
- ❖ Pinpoint Pupil
- ❖ Anorexia, Weight loss and Pallor.
- ❖ Chronic constipation
- ❖ Sweating tremors
- ❖ Also Dermal scars, Amnesia, Confusions and Hallucinations.

PM Appearance

- ❖ **Injection marks** – Dermal abscesses,
- ❖ **Scarring Main areas** – Antecubital fossa, forearm, neck, groin, ankles.
- ❖ Smell of opium while opens the chest
- ❖ Tattooing
- ❖ Emaciation

Dhattura

- ❖ **BN:** Dhattura alba
- ❖ **Family:** Solanaceae
- ❖ **Class of Poison:** Deliriant type of cerebral poison.
- ❖ **Toxic Principles:** Hyoscine (scopolamine), Hyoscyamine, Atropine.
- ❖ **Fatal Dose:** 50-100 seeds–
 - 10 – 100 mg of atropine
 - Fatal period – 24 hours

Signs and Symptoms

- ❖ Dryness of mouth, nausea, vomiting
- ❖ Dysphagia

- ❖ Dilated pupil
- ❖ Diplopia
- ❖ Dry hot skin
- ❖ Drunken gait /ataxia
- ❖ Delirium with confusion, agitation and hallucination.
- ❖ Drowsiness leading to coma
- ❖ Dysuria
- ❖ Death due to Respiratory failure or cardiac arrhythmias.

Bhanga (Vijaya)/Cannabis

- ❖ **Botanical name:** Cannabis sativas/indica
- ❖ **Family:** Cannabinaeae
- ❖ **Type of poison:** Deliriant poison
- ❖ **Toxic part:** All parts of the plants except stem, root, and seed of cannabis.
- ❖ **Active principle:** Tetra hydrocannabinol (THC).

Chronic Poisoning – Signs and Symptoms

Amotivational syndrome (is a chronic Psychiatric disorder characterized by a variety of changes in personality, emotions and cognitive functions such as lack of activity, inward turning, apathy, inability to concentrate).

Chronic abuses of cannabis gradually, became lethargic, apathetic, no interest to work with poor concentration.

Irritant Poisons

Jayapala

- ❖ **BN:** Croton tiglium
- ❖ **Family:** Euphorbiaceae
- ❖ **Class of poison:** Irritant organic
- ❖ **Toxic part:** Seeds and oil
- ❖ **Chemical constituent:** Crotin (Toxalbumen), Crotonoside (Glucoside).

Signs and Symptoms

- ❖ Hot burning pain in mouth, throat, up to abdomen

- ❖ Salivation
- ❖ Nausea
- ❖ Vomiting
- ❖ **Purging** – Gripping pain bloody stool
- ❖ Tachycardia
- ❖ Vertigo
- ❖ Circulatory and respiratory collapse, death.
- ❖ **Fatal dose:** 1-4 crushed seed (1-2 ml of oil)
- ❖ **Fatal period:** 4-6 hours

PM Appearance

- ❖ Red inflamed mucus membrane of stomach and intestine
- ❖ Congested liver and spleen
- ❖ Swollen and congested kidney

Gunja

- ❖ **B.N:** Abrus precatorius
- ❖ **Family:** Loganiaceae
- ❖ **Types of poison:** Organic irritant
- ❖ **Toxic part:** seeds

Toxic Principle

- ❖ Abrin – (toxalbumen)
- ❖ Abrine
- ❖ Abralin

Clinical Features

- ❖ Ingestion of seeds of extract can cause hemorrhagic gastritis with Burning pain in mouth and throat.
- ❖ Sever vomiting
- ❖ Abdominal pain
- ❖ Bloody diarrhoea
- ❖ Elevation of enzymes
- ❖ Cardiac arrhythmia
- ❖ Convulsions

Fatal Dose

- ❖ (90-120 g) mg by injection
- ❖ 1-2 crushed seeds by mouth

PM Appearance

- ❖ The injured site is swollen, inflamed, necrosis.
- ❖ Fragments of sui are usually found in the wound.

Bhallataka

- ❖ **Botanical name:** Semecarpus anacardium
- ❖ **Family:** Anacardiaceae
- ❖ **Class of Poison:** Organic irritant poison
- ❖ **Toxic part:** Ripened seed
- ❖ **Chemical contents:** Semicarpol, bilwanol, anacardic acid.

Clinical Features

- ❖ Skin contact with the juice results inflammation and vesication.
- ❖ Ingestion causes gastro intestinal distress hypotension and delirium.
- ❖ **Fatal dose:** 10 gms
- ❖ **Fatal period:** 12- 24 hours

Arka

- ❖ **Type of poison:** Organic Irritant
- ❖ **Botanical name:** Calotropis procera (white)
Calotropis gigantea (Purple).
- ❖ **Family:** Asclepiadaceae
- ❖ **Toxic part:** Milky juice (kshiram)
- ❖ **Chemical Constituents:** Uscharin, Calotoxin, Calactin.

Clinical Features

- ❖ Vomiting
- ❖ Diarrhoea
- ❖ Mydriasis
- ❖ Convulsion
- ❖ Delirium
- ❖ **Fatal dose:** Uncertain
- ❖ **Fatal period:** ½– 8 hours

Snuhi

- ❖ **Type of Poison:** Irritant poison.
- ❖ **Botanical name:** Euphorbia neriifolia.
- ❖ **Family:** Euphorbiaceae.
- ❖ **Toxic part:** Acrid milky exudate.
- ❖ **Chemical constituents:** Resin, Gums, Turpenes, Euphorbin, Nerifolin.
- ❖ **Fatal dose:** 125 – 250 mg – Dried powder (API)
- ❖ **Fatal period:** 3 days

Langali

- ❖ **Type of poison:** Organic irritant poison, Abortifacient.
- ❖ **Botanical name:** Gloriosa superba
- ❖ **Family:** Liliaceae
- ❖ **Toxic principles:** Colchicine, Superbine
- ❖ **Fatal dose:** 0.75 gm
- ❖ **Fatal period:** Not specific

Important Questions**MCQ**

- The upavisha causes symptoms like viper bite

a. Bhallataka	c. Jayapala
b. Gunja	d. Ganja
- Colchicine is the chemical constituent present in:

a. Arka	c. Langali
b. Gunja	d. Bhallataka
- Uscharine is the active constituent of

a. Arka	c. Langali
b. Gunja	d. Bhallataka
- Burnt rope odour is the characteristic feature of

a. Bhallataka	c. Jayapala
b. Gunja	d. Ganja

5. Shodhana of snuhi is done with

- Arka kshira
- Chincha patra rasa
- Kushmanda rasa
- Ardraka rasa

6. Shodhana of ahiphena is done with

- Arka kshira
- Chincha patra rasa
- Kushmanda rasa
- Ardraka rasa

7. The poison which mimics symptoms like tetanus

- Arka
- Kupilu
- Bhallataka
- Gunja

8. Visha is the synonym of

- | | |
|---------------|---------------|
| a. Kupilu | c. Bhallataka |
| b. Vatsanabha | d. Arka |

9. The poison mistaken for horse radish is

- | | |
|---------------|---------------|
| a. Kupilu | c. Bhallataka |
| b. Vatsanabha | d. Arka |

10. Opium triads are:

- Coma, pinpoint pupil, syncope
- Excitement, respiratory distress, syncope
- Coma, respiratory distress, pinpoint pupil
- Syncope, asphyxia, coma

Answer Key

1. b	2. c	3. a	4. d	5. b
6. d	7. b	8. b	9. b	10. c

Learning Objectives

- Describe the active principles, mode of action, fatal dose, fatal period, signs and symptoms, management and post-mortem appearance and medico-legal aspects of Vatsanabha, Karaveera, Digitalis, Tobacco, Kupeelu, Cerbella odollam, Ahiphena, Dhatura, Bhanga, Jayapala, Gunja, Bhallataka, Arka, Snuhi and Langali.

Important SAQ

- Write about upavishas and their numbers according to various Acharyas.
- Write differences between kupilu poisoning and tetanus.
- Explain Bhallataka poisoning.
- Explain chronic poisoning of cannabis.
- Write briefly about the fatal dose, fatal period signs and symptoms of poisoning due to ganja.

Important LAQ

- Enlist different cardiac poisons and briefly explain vatsanabha.
- Enlist different neurotoxic poisons and briefly explain ahiphena.
- Explain dhatura poisoning and its forensic importance.
- Explain and enlist the organic irritants and bhallataka visha.
- Explain kupilu poisoning and its medico-legal significance.

Sthavara Visha – Poisons of Metallic Origin

10.1 Arsenic

Arsenic

Metallic arsenic is not poisonous and is water, soluble, allowing it to be excreted from the body.

Commonly available forms are:-

- ❖ Arsenic trioxide (As_2O_3)
- ❖ Arsenic sulphide – As_2S_2 (realgar) and As_2S_3 (orpiment)
- ❖ Copper arsenite (Scheele's green) copper aceto arsenite (paris green)
- ❖ Arsine (AsH_3) is a gas

Action

Arsenic impairs the cellular oxidation and inhibits the mitochondrial enzymes, especially pyruvate oxide and phosphatase by combining with SH groups :

- ❖ It is a potent capillary poison
- ❖ It acts on the vascular endothelium
- ❖ It causes haemorrhagic gastroenteritis

Fatal dose

180–200 mg

Fatal period

12–24 hours

Signs and Symptoms

Types of Arsenic Poisons

1. Fulminant type

2. Gastroenteric type

3. Narcotic form

Fulminant Type

In case of massive dose of arsenic (3–5gm), death occurs due to peripheral vascular failure:

- ❖ All capillaries dilated
- ❖ Fall of BP
- ❖ Acute myocarditis
- ❖ Ventricular tachycardia
- ❖ Ventricular fibrillation
- ❖ Death occurs in 2–3 hours

Gastroenteric type: Symptoms include

Throat pain, vomiting and purging.

- ❖ Symptoms start after $\frac{1}{2}$ –1 hours of ingestion.
- ❖ Abdominal pain, intense thirst, vomiting.
- ❖ Diarrhoea with tenesmus.
- ❖ Stool is expelled continuously and involuntarily.
- ❖ Stool – colourless, odourless and watery resembling like rice water stool of cholera.

Hepatic

- ❖ Fatty changes in the liver and jaundice may occur.

Renal

Oliguria, anuria, albuminuria, renal tubular necrosis

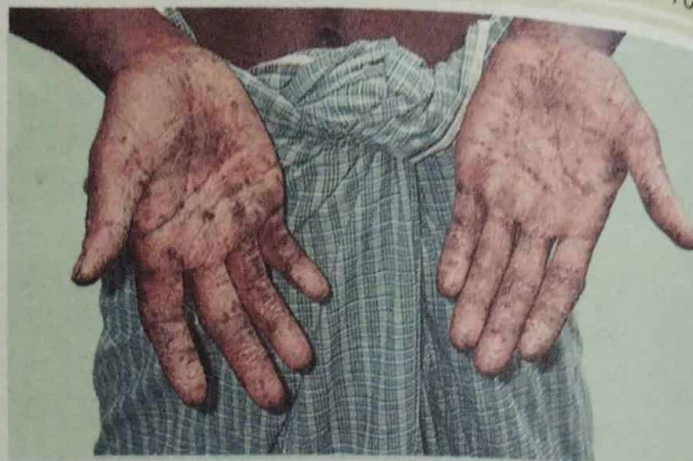
Narcotic Form

It results from ingestion of large dose of arsenic.

Symptoms

- ❖ CNS depression
- ❖ Headache
- ❖ Vertigo
- ❖ Tremors
- ❖ Muscular cramps
- ❖ Convulsion
- ❖ Delirium, coma, death.

(See the table next page)



Treatment

1. Stomach wash can be done with luke warm water and milk
2. Chelating agent – BAL (dimercaprol) 400-800mg can be taken for the second and third day in every 4 hours
3. Castor oil or magnesium sulphate is given to prevent intestinal absorption
4. Glucose saline can be given
5. Haemodialysis or exchange transfusion can be done if necessary
6. Chelation therapy is ineffective in arsine (AsH_3) poisoning

PM appearance

1. GIT congestion – Red velvety appearance of gastric mucosa.
"Flea bitten appearance" is said to be a characteristic.
2. Lungs & Brain – congested – oedematous

Signs & symptoms

In general – System wise

(see the table next page)

Forensic Importance

1. **Homicide:** Ideal homicidal poison since it is colourless, odourless, tasteless, substance can be mixed with food.
2. **Suicide also occurs**
3. **Accidental:** Chances of accidental poisoning in children and also due to contamination with food particles.
4. **Cattle poison:** When have animals food mixed with arsenic.
5. **Abortifacient:** Given orally or applied locally
6. Arsenic can be detected in decomposed bodies/buried bodies
7. It can be detected in charred bones and ashes.

Tests to detect arsenic

- ❖ Reinsch test and Marsch test are both chemical tests used to detect the presence of specific elements in a substance especially in forensic toxicology.

No.	Factors	Arsenic Poisoning	Cholera
1.	Pain in throat	Starts before vomiting	Not usual, if present after vomiting.
2.	Voice	Normal	Rough and whistling
3.	Conjunctiva	Inflamed	Normal
4.	Vomiting	Starts before purging	Starts after purging
5.	Vomit	Vomit contains blood, bile and mucus.	Watery without blood and bile
6.	Purging	Starts after vomiting	Starts before vomiting
7.	Stool	Stool is not exactly rice water, but contains blood, offensive smell.	Rice water stool, passed involuntary like a jet.
8.	Tenesmus	Present	Absent
9.	Investigation	Direction of arsenic on chemical examination.	Vibrio cholera bacteria detected in stool examination.

System	Acute	Chronic
Dermal	Hair loss, transverse bands on nails (mees line).	Melanosis, bowe's disease, facial oedema hyperkeratosis, rain drop pigmentation, skin cancer.
GIT	Abdominal pain, metallic taste, garlicky breath, dysphagia, vomiting, Rice water stool.	Anorexia, nausea, vomiting, diarrhoea, weight loss.
Liver	Fatty degeneration	Hepatomegaly, jaundice, cirrhosis
Kidney	Oliguria, uraemia	Nephritic changes
Neurological	Hyperpyrexia, convulsions, coma	Encephalopathy, poly neuritis tremor
Haematological	—	Anaemia leukopenia thrombocytopenia basophilic stippling
Heart	Cardiac arrhythmia	—

❖ **Reinsch test** is primarily used for detecting Arsenic, Antimony and Bismuth in biological samples. It is done by exposing a sample to a strip of clean copper in the presence of Hydrochloric acid. If it forms coloured deposits, it indicates the presence of Arsenic and other samples.

❖ **Marsch test:** It is used to detect only Arsenic in biological samples. It involves generating Arsine gas from the sample by reacting it with zinc and Hydrochloric acid. Arsenic if present in the sample appears like metallic ring in the test tube.

10.2 Mercury

Chemical formula: Hg (Hydrargyrum)

Mercury is a liquid metal and has no poisonous effect when swallowed. But mercury vapours are very poisonous when inhaled.

Types of Salts: Organic and inorganic salts of mercury are present. Organic salts are more poisonous than inorganic salts. Example of organic salt: Methyl mercury. Common inorganic salts are: Mercuric chloride, mercuric sulphide, mercurous salt (calomel) and so on.

Sindoor: It is an orange red colour cosmetic powder usually worn by married Indian woman. It is made with mercury sulphide (HgS) as a major component.

Action

After absorption, it is distributed in the blood cells plasma. It diffuses into the tissues and binds with sulphhydryl groups (SH). It interferes with cellular proteins and cellular transport. Mercury is deposited mainly in kidney, liver, spleen and CNS. It is excreted through urine, saliva, sweat, milk and faeces.

Fatal dose: Mercuric chloride (1-2 gm).

Signs & Symptoms

Acute poisoning

- ❖ Metallic taste in the mouth
- ❖ Constriction of throat
- ❖ Hot burning pain
- ❖ Mouth, tongue, and oesophagus are corroded
- ❖ Diarrhoea with abdominal pain

Treatment

1. Demulcent drinks like egg white, milk, etc. can be given to protect stomach mucosa.
2. Stomach wash by 5% sodium bicarbonate solution in water with 5% sodium formaldehyde
3. Activated charcoal
4. Chelating agent BAL is used.

Chronic mercury symptoms (Hydrargyris)

It occurs in industrial workers.

Signs and Symptoms

- ❖ Stomatitis
- ❖ Gingivitis
- ❖ Salivation
- ❖ Blue line on gum
- ❖ Acrodynia Tremors
- ❖ Mercuria lentis
- ❖ Erethism (mercurial erethism)

- ❖ Membranous glomerulonephritis
- ❖ Minimata disease

Acrodynia/pink disease/swift disease



This is an idiosyncratic hypersensitivity reaction caused by chronic organic mercury exposure. It is particularly seen in children in chronic mercury poisoning (mercurous chloride in teething powder).

Characterised by—

- ❖ Anorexia
- ❖ Photophobia
- ❖ Insomnia
- ❖ Profuse sweating
- ❖ Irritation of hands and feet followed by desquamation
- ❖ Loss of hair
- ❖ Hyperkeratosis
- ❖ Pain in extremities, also hands and limbs become puffy, pinkish, painful, parasthaetic, teeth may be shed.

Mercurial erethism

It is a neuropsychiatric symptoms in chronic mercury poisoning, especially in hat making industry in which prolonged exposure to mercuric vapours occurs.

Other features include—

- ❖ Timidity
- ❖ Loss of confidence
- ❖ Explosive irritability
- ❖ Insomnia

- ❖ Hallucination and delusion
- ❖ Suicidal tendency
- ❖ Depression
- ❖ Emotional instability
- ❖ Amnesia

This condition is called mad hatter. (It is a character in a novel 'Alice in Wonderland' who showed signs of mercurial erethism)

Mercurial tremors

- ❖ Hands are affected first and it's called "Danbury Tremors".
- ❖ Then it progresses to lips and tongue.
- ❖ Advanced stage is called **Hatter's shake** or "Glass bowers shake."

This type of tremors are common in persons working in hat making or glass making factories.

This condition progresses and patient makes unable to work or do his routine activities. Most severe condition is called **concussion – mercurialis**.

Mercuria lentis

It occurs due to exposure to vapour of mercury. There will be a brownish deposit of mercury on the cornea and anterior lens capsule.

Membranous glomerulonephritis: In kidney, mercuric ion causes damage to renal tubules is the condition.

Minamata Disease

This was a chronic organic mercury poisoning in people who consumed mercury contaminated fish and shellfish from Minamata Bay in Japan.

Symptoms are–

- ❖ Disturbance in hand co-ordination
- ❖ Gait and speech abnormalities present
- ❖ Difficulty in chewing and swallowing
- ❖ Tremors with neurological symptoms

- ❖ Blurring of vision
- ❖ Clouding of consciousness and seizures.

Treatments

1. Remove the patient from the source of exposure.
2. BAL 4mg/kg body weight/every 4 hours
3. Oral hygiene maintenance can help to prevent further exposure
4. Demulcents

10.3 Lead

Chemical formula: Plumbum (Pb)

Pure metal is non-poisonous, but its compounds are poisonous. Common lead compounds are:–

Lead acetate (sugar of lead), lead chromate (litharge), lead carbonate (white lead), lead sulphide (galena), lead tetroxide (vermillion) and TEL (tetra ethyl lead) are compounds–

- ❖ Lead poisoning is commonest heavy metal poisoning.
- ❖ Metallic lead and all its salts are poisons.
- ❖ Metallic lead is absorbed through GIT
Lead is a cumulative poison mostly stored in bones.

Action

- ❖ Lead adversely affects mitochondrial oxidative phosphorylation.
- ❖ Lead causes hemolysis of mature RBC.
- ❖ Lead causes degenerative changes of extensor muscles of extremities and peripheral nerves.

Fatal dose: 20gm of lead acetate, 40gm of lead carbonate.

Fatal period: 2-3 days.

Signs and Symptoms of Acute Poisoning

- ❖ Metallic taste in the mouth
- ❖ Dry throat
- ❖ Intense thirst

- ❖ Abdominal pain
- ❖ Nausea vomiting
- ❖ Peripheral circulating collapse
- ❖ Headache, lethargy, myalgia, depression, coma, convulsion and death.

Chronic Lead Poisoning (plumbism/saturnism)

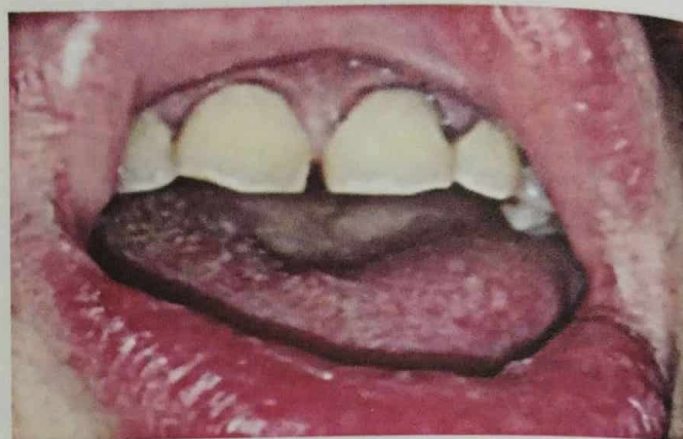
- ❖ It occurs in industrial workers by cutaneous and inhalation.
- ❖ It occurs through drinking water, contaminated through pipeline.
- ❖ Children accidental licking or chewing lead pencils and toys.
- ❖ Eating contaminated food stored in lead containers.

Signs and Symptoms

1. **Facial pallor** occurs due to vasospasm of capillaries particularly around the mouth.
2. **Anaemia:** Basophilic stippling, punctuate basophilia.
3. **Lead line:** Burtonian's line, bluish line on the gum due to the deposition of lead sulphide.
4. **Lead colic/saturnine colic:** Abdominal pain
5. **Constipation:** Usual symptom
6. **Lead palsy:** Numbness, paraesthesia, cramps of muscles of extremities, wrist drop, foot drop, claw-shaped hands.
7. **Lead encephalopathy:** This is common in children and often associated with Tetra Ethyl Lead and (TEL)
8. **Retinal stippling:** Greyish glistening lead particles seen on the retina is this condition.
9. **Saturnine gout:** Joint pain occurs due to inhibition of uric acid crystals elimination by lead.
10. **Hair:** There may be alopecia.

Lead line or burtonian line: This is a very important feature of chronic lead poisoning.

This is a blue black discolouration of the gums which always occurs on the edge of the gum at its junction with teeth. It is usually seen in upper jaw. Similar lines are also seen in poisoning of mercury, copper, bismuth, silver and iron.



Lead palsy: It is a very common issue in CLP (Chronic Lead Poisoning) It is more common in males than in females. Initially muscle weakness develops and later fatigue, peripheral neuropathy lead to increased nerve conduction time, and slowly paralysis of the muscles occurs. Wrist drop (all extensor muscles of wrist are affected) and foot drop (all extensors of feet are affected) occur.

Lead encephalopathy: It is most common in children, and mainly occurs in the poisoning due to TEL (sucking crayons and pencils). It is irreversible in most of the times and causes permanent brain damage. Features: Personality changes, insomnia, irritability, restlessness, headache, vomiting,

mental retardation, delirium, hallucination, convulsions and coma.

Lead colic: It is the abdominal pain seen in CLP. This occurs due lead's negative affect on smooth muscles of intestines, uterus and ureters. This colic usually occurs in the night (nocturnal). It is sudden, very severe, spasmodic and intermittent and is usually felt around the umbilicus.

Basophilic stippling: Blood picture of lead poisoning shows anaemia with basophilic stippling.

Anaemia: It occurs when lead concentration occurs at 70-80mg% of blood. Anaemia occurs due to impaired synthesis of haem and increased fragility of RBCs.

Basophilic stippling or punctuate basophilia: It is a very peculiar feature of aneamia seen in CLP. RBC first shows **Cabot's** ring and then basophilic stippling. Many discrete dark blue pinhead sized spots are found in the cytoplasm.

Diagnosis

1. From Clinical features
2. Complete blood count and peripheral smear
3. Blood lead level assessment
4. Urine concentration of Aminole-vulinic acid (ALA).

Radiological investigation

Dense transverse bands at growing ends of bones, (just underneath the metaphyseal plates) around the wrists and knees on the x-ray.

Treatments

- ❖ Removal from the source of poisoning
- ❖ Chelation therapy
- ❖ BAL-4 mg/kg immediately
- ❖ Calcium gluconate for abdominal colic.

PM appearance

Pale skin, conjunctiva, mucosa, emaciation, burton line on gum, lead line on x-ray, brain pale and oedematous, heart hypertrophied, liver and kidney contracted, and muscles show fatty degeneration.

MLA

- ❖ People affected with chronic lead poisoning have increased lead levels in the semen causing lower fertility rate.
- ❖ An employer is liable to pay compensation if employees is suffer from CLP due to occupation.
- ❖ Lead encephalopathy is usually irreversible and causes permanent brain damage and death.

10.4 Copper



Physical Appearance

- ❖ Brown colour metallic copper which is non-toxic.
- ❖ Part of normal constituent of human body.
- ❖ But salts of copper are poisonous.

Fatal dose

10-20 Gm of copper sulphate (blue vitriol).

Clinical Features

- ❖ **Acute poisoning**
 - Myalgia
 - Abdominal pain
 - Vomiting
 - Diarrhoea
 - Acidosis

- Haemolysis, jaundice, oliguria, renal failure.
- Eye exposure to copper can results in conjunctivitis and corneal ulceration.
- Copper deposited in the lens called **chalcosis lentis**, can results in uveitis, abscess, serious injury or loss of eye.

Chronic Poisoning

- ❖ Chronic inhalation of copper sulphate spray used as insecticide in vineyards causes – **Vineyard's spayer's lung disease** characterised by histocytic granulomatous lung.
- ❖ Frequent contact of swimming pool/ water containg algicidal copper causes **green discolouration** of hair.
- ❖ Cooking in copper or brass vessels causes chronic copper poisoning.
- ❖ Chronic copper toxicity is a hallmark of **Wilson's disease** autosomal recessive genetic disorder with deficiency of ceruloplasmin.
- ❖ Discolouration of peripheral part – of cornea (Kayser – Fleischer – Ring).

Diagnosis

- ❖ Blood copper level (if it exceeds 1.5 mg/100ml).
- ❖ Serum ceruloplasmin level (value of 35% or less in 24 hours, associated with serious toxicity).

Treatments

- ❖ Haemodialysis in early stages of poisoning.
- ❖ Demulscents such as – Egg white or milk.
- ❖ Stomach wash with potassium ferro cyanide.
- ❖ **Emesis contraindicated**

PM Appearance

- ❖ Jaundiced skin and conjunctiva
- ❖ Greenish blue froth
- ❖ Greenish or bluish stomach mucosa and contents
- ❖ Hepatic and renal necrosis

Forensic Importance

- ❖ Suicidal cases reporting in India.
- ❖ Chronic poisoning already mentioned.

Summary

Arsenic

Arsenic is a grey substance. It is non-poisonous as it is not soluble in water and therefore cannot be absorbed from alimentary canal. But white arsenic or arsenic oxide is tasteless and highly poisonous. Arsenic causes poisoning by combining with sulphhydryl group of enzymes, and thus interferes with cellular metabolism. Locally it causes irritation of mucus membrane and remotely depression of the nervous system.

Acute poisoning: Symptoms manifest within 15-30 minutes after the dose, but may be delayed if arsenic is taken with food.

There is nausea and burning pain in the oesophagus, stomach and epigastrium, severe continuous vomiting. Diarrhea presented with tenesmus and anal imitation. The stools are tinged with blood, the stools are tinged with blood, watery like ice water stools of cholera. Intense thirst is a constant feature but drinking water accelerates vomiting. Urine suppressed and painful cramps in the legs due dehydration. Skin eruptions may appears in the late stage. When a large dose of arsenic is taken, and the poison is quickly, absorbed, the symptoms of gastroenteritis may be present,

and symptoms of narcotic poisoning such as vertigo, headache, spasm followed by stupor and vascular collapse. Death occurs in 2-3 hours.

Fatal dose: 180-200 mg

PM Appearance

1. GIT congestion – Red velvety appearance of gastric mucosa.

“Flea bitten appearance” is said to be characteristic.

2. Lungs & Brain – congested – oedematous

Mercury

Metallic mercury is not poisonous, as it is not absorbed in the body. Mercuric compounds are soluble are more poisonous than mercurous compounds which are less soluble.

Signs and Symptoms

The symptoms starts soon after the poison is swallowed. The taste is metallic and feeling of constriction in the throat, burning sensation from mouth to throat. There is nausea, with frequent vomiting of long stringy masses of white mucus, mixed with blood, followed by profuse purging often bloody, with painful tenesmus. Collapse sets in with cold clammy skin pale anxious face, sunken eyes, dilated pupils, rapid and feeble pulse and sighing respirations. Finally syncope, convulsions proceeds to death.

Fatal dose: 1-2 gms of mercuric chloride

Postmortem signs

Large intestine necrosed

Kidney damage consists of tubular necrosis.

Lead

Lead compounds are very poisonous than the lead in metallic state. The primary effect of lead is causing spasm of capillaries and arterioles.

Signs and Symptoms

The symptoms consist of metallic astringent taste, dry throat, thirst nausea and vomiting and colicky pain in the abdomen relieved by pressure. There is purging but more usually constipation. Urine is suppressed and faeces are dark black coloured and offensive due to the formation of lead sulphide. Leg cramps and arthralgia present. Headache, drowsiness and paralysis of the limbs may be observed. Collapse and proceeds to death. In poisoning with tetra ethyl lead gastric symptoms are absent and more present lead encephalopathy. The patient may suffer from permanent mental changes or insanity.

Fatal dose: 0.5 gm

Chronic poisoning/plumbism

- ❖ Facial pallor
- ❖ Anaemia with punctuate basophilia
- ❖ Lead line on at the junction of gum and teeth
- ❖ Colic and constipation
- ❖ Paralysis
- ❖ Lead encephalopathy
- ❖ Renovascular manifestations
- ❖ Reproductive system manifestations
- ❖ General weakness
- ❖ Anorexia
- ❖ Dyspepsia

PM Appearance

Pale skin, conjunctiva, mucosa, Emaciation, Burton line on gum, Lead line on x-ray, brain pale and oedematous, Heart hypertrophied, liver and kidney contracted, muscles shows fatty degeneration.

Copper

Fatal dose

10-20 Gms of copper sulphate (blue vitriol)

Signs and Symptoms

Symptoms commences in 15-30 minutes with a metallic taste in the mouth, salivation,

thirst, burning in the stomach, colicky abdominal pain, vomiting diarrhea, and collapse :

- ❖ The vomitus appears green or blue.
- ❖ The stools are liquid and brownish but not bloody.
- ❖ In severe cases jaundice and muscle cramps occurs.

❖ Convulsions and coma proceeds to death.

Postmortem Appearance

The skin may be yellowish owing jaundice. Greenish or bluish froth present at the nose and mouth.

Greenish or bluish coloration of the gastric mucosa and stomach content is diagnostic. Liver may be soft and fatty.

Important Questions MCQ

1. The metallic poison which mimics symptoms like cholera is
 - a. Mercury poisoning
 - b. Lead poisoning
 - c. Arsenic poisoning
 - d. Copper poisoning
2. Scheele's Green is a poison it is actually
 - a. Mercuric chloride
 - b. Arsenic oxide
 - c. Copper arsenite
 - d. Lead sulphide
3. Flea bitten appearance is a PM sign in
 - a. Mercury poisoning
 - b. Lead poisoning
 - c. Arsenic poisoning
 - d. Copper poisoning
4. Red Velvety appearance of stomach mucosa is seen in
 - a. Alkali poisoning
 - b. Lead poisoning
 - c. Arsenic poisoning
 - d. Acid poisoning
5. Erethism is the clinical feature present in
 - a. Mercury poisoning
 - b. Lead poisoning
 - c. Arsenic poisoning
 - d. Copper poisoning
6. Acrodynia is clinical presentation in children seen in
 - a. Mercury poisoning
 - b. Lead poisoning
 - c. Arsenic poisoning
 - d. Copper poisoning
7. Mad hatter is seen in
 - a. Mercury poisoning
 - b. Lead poisoning
 - c. Arsenic poisoning
 - d. Copper poisoning
8. Basophilic stippling is seen in
 - a. Mercury poisoning
 - b. Lead poisoning
 - c. Arsenic poisoning
 - d. Copper poisoning
9. Foot drop and wrist drop are the common symptoms in
 - a. Mercury poisoning
 - b. Lead poisoning
 - c. Arsenic poisoning
 - d. Copper poisoning

10. The poisoning is presenting like Wilson diseases

- Mercury poisoning
- Lead poisoning
- Arsenic poisoning
- Copper poisoning

11. Vineyards Sprayers lung disease is a characteristic feature of

- Mercury poisoning

- Lead poisoning
- Arsenic poisoning
- Copper poisoning

Answer Key

1. c	2. c	3. c	4. c	5. a	6. a
7. a	8. b	9. b	10. d	11. d	

Learning Objectives

- Describe the mode of action, fatal dose, fatal period, signs and symptoms, management, post-mortem appearance, medico-legal aspects of arsenic, mercury, lead and copper.
- Describe the Ayurvedic concepts for the diagnosis and management of chronic heavy metal toxicity.

Important SAQ

- Write a short note on saturnism.
- What are the differences between arsenic poisoning and cholera?
- Write about the post-mortem signs of arsenic.
- Write a short note on minaimata disease.
- Write a note on management of heavy metal poisoning.

Important LAQ

- Explain acute and chronic arsenic poisoning. Write the signs and symptoms and about the management and PM signs.
- Explain acute and chronic mercury poisoning. Write the signs and symptoms and on the management and PM signs.
- Explain acute and chronic lead poisoning. Write the signs and symptoms and on the management and PM signs.
- Explain acute and chronic copper poisoning. Write the signs and symptoms and on the management and PM signs.

• • •

Jangama Visha

Jangama Visha

दंष्ट्रिणो ये विषं तेषां दंष्ट्रोत्थं जङ्गमं मतम् ।

(Cha. Chi. 23/10)

Jangama visha is the type of visha which is of animal origin. It includes poison of serpents, insects, rats, spiders, scorpions, house lizard, leech, fishes, frog, hornets, etc.

जङ्गमं स्यादधोभागमूर्ध्वभागं तु मूलजम् ।

(Cha. Chi. 23/17)

Jangama visha gati is directed downwards.

सर्पाः कीटोन्दुरा लूता वृश्चिका गृहगोधिकाः ।

जलौकामत्स्यमण्डूकाः कणभाः सकृकण्टकाः ॥

श्वसिंहव्याघ्रगोमायुतरक्षुनकुलादयः ।

दंष्ट्रिणो ये विषं तेषां दंष्ट्रोत्थं जङ्गमं मतम् ।

(Cha. Chi. 23/9-10)

Snakes, insects, spiders, scorpions, house lizards, leeches, fishes, frogs, locust (kanabha), krikantaka (chamelion), dogs, lion, tiger, gomaya (jackal), tarakshu, mangoose, etc. are fanged animals. The poison of these creatures constitute animal poisons (jangama visha).

निद्रां तन्द्रां क्लमं दाहं सपाकं लोमहर्षणम् ।

शोफं चैवातिसारं च जनयेज्जङ्गमं विषम् ॥

(Cha. Chi. 23/15)

निद्रा	Sleepy
तन्द्रा	Tiredness

क्लम	Mental fatigue
दाह	Burning sensation
पाकम्	Inflammation
लोमहर्षणम्	Horripilation
शोफम्	Swelling
अतिसारं	Diarrhoea

11.1 Sarpa Visha

Sarpabheda/Classification of Sarpa

Sarpa classified broadly as two—

1. Divya sarpa
2. Bhauma sarpa

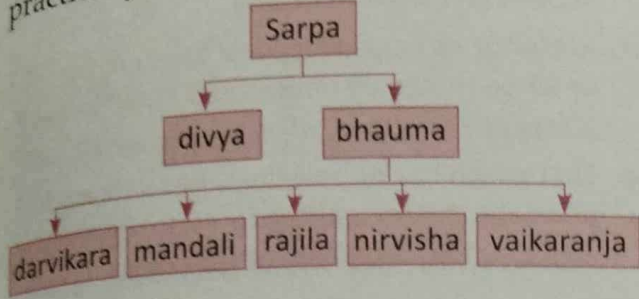
Divya sarpas are vasuki, takshaka, ananta, sagara, sagalaya, nanda, upananda, etc. They are like fire (agni sama). Visha affects even by their drushti (sight) and niswaasa (breath).

Bhauma Sarpa

Total number: (80 in number) sub-divided into 5 types:

- ❖ Darvikaa-26 in number
- ❖ Mandali-22 in number
- ❖ Rajila- 10 in number
- ❖ Nirvisha-12 in number
- ❖ Vaikaranjasarpa and Vaikaranjot-bhavasarpa- 10 in number (3+7=10)

We focus here more on the three Bhauma sarpa that is Darvikara, Mandali and Rajila as their bites are most common and practically important.



Reasons for Bite

आहारार्थं भयात् पादस्पर्शादतिविषात् क्रुधः ॥
पापवृत्तितया वैरादेर्वर्षियमचोदनात् ॥
दशन्ति सर्पास्तेषूक्तं विषाधिक्यं यथोत्तरम् ॥

(A.H.U.36/8-9)

Snake bites a person out of fear, when touched by the foot, and due to more accumulation of poison, anger to those who indulge in sinful acts, hatredness and instigation by gods, sages and lord of death. Among these, effect of poison is greater in the successive order.

Time of Bite

रज्याः पश्चिमे यामे सर्पश्चित्राश्चरन्ति हि ।
शेषेषूक्ता मण्डलिनो दिवा दर्वीकराः स्मृताः ॥

(Su. Ka. 4/30)

- ❖ Darvikara- in day time
- ❖ Rajila- last yama of night
- ❖ Mandali- in first and second yama of night

Alpa vishata (reason for little quantity of poison)

जलाप्लुता रतिक्षीणा भीता नकुलनिर्जिताः ।
शीतवातातपव्याधिक्षुत्तृष्णाश्रमपीडिताः ॥
तूर्ण देशान्तरायाता विमुक्तविषकञ्चुकाः ।
कुशौषधिकण्टकवद्ये चरन्ति च काननम् ॥
देशं च दिव्याध्युषितं सर्पास्तेऽल्पविषा मताः ।

(A. H. U. 36/28-29)

Snakes which are drenched in water, debilitated by mating, frightened, vanquished by mongoose, suffering from cold breeze, sunlight, disease, hunger, thirst and exertion, have

just arrived from a foreign land, cast off its poison and peel (skin), move in forest full of kusa plant medicinal plants and thorny plants which dwell in places where gods reside are known to possess very little quantity of poison.

Types of bites/damsa bheda

यत्र लालापरिक्लेदमात्रं गात्रे प्रदृश्यते ।
न तु दंष्ट्राकृतं दंशं तत्तुण्डाहतमादिशेत् ॥
एकं दंष्ट्रापदं द्वे वा व्यालीढाख्यमशोणितं ।
दंष्ट्रापदे सरक्ते द्वे व्यालुप्तं, त्रीणि तानि तु ॥
मांसच्छेदादविच्छिन्नरक्तवाहिनि दष्टकम् ।
दंष्ट्रापदानि चत्वारि तद्वदष्टनिपीडितम् ॥
निर्विषं द्वयमत्राद्यमसाद्यं पश्चिमं वदेत् ।

(A.H.U.36/11-13)

दंशभेदं	Features
तुण्डाहतं	• Only deposit of saliva rubbing with teeth only. • No bite
व्यालीढं	• 1 or 2 teeth marks seen • No bleeding
व्यालुप्तं	• 2 bite marks with bleeding
दष्टकं	• 3 bite marks, continuous bleeding • tear of muscles.
दष्टनिपीडितं	• 4 bite marks

Prognosis

- ❖ Tundahatam and Vyaaleeda are nirvisha.
- ❖ Dashtakam and Vyaluptham – sadhya with proper treatment.
- ❖ Dashtanipeeditam – asadhya /difficult to cure.

According to Sushruta Samhita

3 in numbers

पदानि यत्र दन्तानामेकं द्वे वा बहूनि वा ।
निमग्नान्यल्परक्तानि यान्युद्धृत्य करोति हि ॥
चञ्चुमालकयुक्तानि वैकृत्यकरणानि च ।
सङ्क्षिप्तानि सशोफानि विद्यात्तत् सर्पितं भिषक् ॥
राज्यः सलोहिता यत्र नीलाः पीताः सितास्तथा ।
विज्ञेयं रदितं तत्तु ज्ञेयमल्पविषं च तत् ॥
अशोफमल्पदुष्टासृक् प्रकृतिस्तस्य देहिनः ।
पदं पदानि वा विद्यादविषं तच्चिकित्सकः ॥

(Su.Ka.4/14-18)

Sarpadamsha		Features
Sarpita	1 or 2 more Danta kshata, Alparakta (bleeding less), Udrutyakaroti (raised), Chanchumalaka yuktahaani (sprout like eruptions)	1 or 2 bite marks are visible, which are deep and little bleeding, when squeezes give rise to sprout like eruptions which are minute and accompanied with swelling.
Ratida	Alparaktam (bleeding less), Lohita Nila Pitha Sitha Raji coloured.	Presence of lines which are bluish red yellow or white should be understood as radita which is less poisonous.
Nirvisha	Asopha Alpadushtaasrik, Prakrita sarpa bitten (bitten by normal snake not angry, not hungry etc).	That which has no swellings, has little amount of vitiated blood is bitten by normal snake (not angry, not hungry) and non-poisonous.

- ❖ Some include Sarpangabhihata as one of Damsavisesham

According to Charaka Samhita

दंशभेदम्/Types of Bite

- ❖ गूढसम्पादितम्
- ❖ वृत्त
- ❖ पीडितम्
- ❖ लम्बितार्पितं
- ❖ सर्पितं
- ❖ भृशाबाधं

Sarpangabhihata/ सर्पाङ्गाभिहत

भीरोस्तु सर्पसंस्पर्शाद्भयेन कुपितोऽनिलः ।
कदाचित्कुरुते शोफं सर्पाङ्गाभिहतं तु तत् ।

(A.H.U. 36/15-16)

In those who are very frightful, vata gets aggravated by the fear of touch of snakes, gives rise to a swelling (at the place of contact). This condition is called sarpangabhihata.

Shankavisha/ शङ्काविष

दुर्गन्धकारे विद्धस्य केनचिद्दृष्टशङ्कया ।।
विषोद्वेगो ज्वरछर्दिर्मूर्च्छा दाहोऽपि वा भवेत् ।
ग्लानिर्मोहोऽतिसारो वा तच्छङ्काविषमुच्यते ।।

(A.H.U. 36/16-17)

Bitten by any other animal (other than snakes) in darkness, the person suspects it to be a snake only and develops symptoms of poisoning such as fever, vomiting, fainting, burning sensation or exhaustion, delusion and diarrhoea. This condition is called Shankaavisha.

Management

सिता वैगन्धिको द्राक्षा पयस्या मधुकं मधु ।
पानं समन्त्रपूताम्बु प्रोक्षणं सान्त्वहर्षणम् ।।
सर्पाङ्गाभिहते युञ्ज्यात्तथा सशङ्काविषादिते ।

(A.H.U. 36/89)

Sita, vaigandhika, daksha, payasya, madhukam and madhu should be consumed, sprinkling with water sanctified by holy hymns, assurance and creating pleasure. These treatments should be administered to person suffering from sankavisha and sarpankabhihata.

Bhauma Sarpa

Qualities of visha of various snakes

दर्वीकरा मण्डलिनो राजिमन्तश्च पन्नगाः ।
त्रिधा समासतो भौमाः, भिद्यन्ते ते त्वनेकधा ।।
व्यासतो योनिभेदेन नोच्यन्तेऽनुपयोगिनः ।

(A.H.U. 36/1)

Bhauma sarpa or snakes living in the earth are of 3 types—

1. Darvikara
2. Mandali
3. Rajimanta or Rajila

विशेषादूक्षकटुकमम्लोष्णं स्वादुशीतलम् ।।
विषं दर्वीकरादीनां क्रमाद्वातादिकोपनम् ।

(A.H.U. 36/2)

Snakes	Guna of visha	Dosha predominance
Darvikara	Rooksha, Katu	Vata Kopaka
Mandali	Amla, Ushna	Pitta Kopana
Rajila	Svadu, Sitalam	Kapha Kopana

Time when maximum poison

तारुण्यमध्यवृद्धत्वे वृष्टिशीतातपेषु च ।
विषोल्बणा भवन्त्येते व्यन्तरा ऋतुसन्धिषु ।

(A.H.U. 36/3)

(See the table down)

Morphological Features of Snakes**Darvikara**

रथाङ्गलाङ्गलच्छत्रस्वस्तिकाङ्कुशधारिणः ॥
फणिनः शीघ्रगतयः सर्पा दर्वीकराः स्मृताः ।

(A.H.U. 36/4)

Snakes which have the marks of either a wheel, plough, swastika or a hook/goad of elephant and move very fast are called Darvikara.

Mandali

ज्ञेया मण्डलिनोऽभोगाः मण्डलैर्विविधैश्चिताः ॥
प्रांशवो मन्दगमनाः । (A.H.U. 36/5)

Snakes which have no hoods, are covered with patches of different size on their body, big in size and slow in movement are known as mandali.

Rajila

राजिमन्तस्तु राजिभिः ।
स्निग्धा विचित्रवर्णाभिस्तिर्यगूर्ध्वं च चित्रिताः ॥

(A.H.U. 36/6)

Snakes which have shining line, running side wards and upwards of different colours on their body are Rajimanta or Rajila.

Darvikara Damsa Lakshana

तत्र, दर्वीकरविषेण त्वङ्नयननखदशनवदनमूत्रपुरीष-
दंशकृष्णत्वं रौक्ष्यं शिरसो गौरवं सन्धिवेदना कटीपृष्ठ-
ग्रीवादौर्बल्यं जृम्भणं वेपथुः स्वरावसादो घुर्घुरको
जडता शुष्कोद्गारः कासश्वासौ हिक्का वायोरूर्ध्वगमनं
शूलोद्वेष्टनं तृष्णा लालास्रावः फेनागमनं स्रोतोऽवरोध-
स्तास्ताश्च वातवेदना भवन्ति । (Su. Ka. 4/37)

त्वक् नयन नख	Blackness of Skin, Eyes, Nails,
दशन वदनमूत्र	Teeth, Face, Urine, Faeces,
पुरीष दंश कृष्णत्वं	And Place of Bite.
रौक्ष्यं	Roughness
शिरसो गौरवं	Heaviness of the head
सन्धिवेदन	Painful joints
कटि पृष्ठ ग्रीवा	Weakness of waist back
दौर्बल्यम्	and neck
जृम्भणं	Yawning
वेपथु	Trembling
घुर्घुरक	Sound while beathing
स्वरावसादं	Hoarseness
जडता शुष्कोद्गार	Dullness, Dry eructation
कास श्वास	Cough, Dyspnoea
हिक्का	Hiccough
वायोरूर्ध्वगमनं	Upward movement of Vayu
शूलोद्वेष्टनं	Cramps due to Pain
तृष्णा	Thirst

Snakes	Age at which the poison is maximum	Season
Darvikara	Tarunya	Vrishti –Rainy season
Mandali	Madhya	Shitha Kala –Winter season
Rajila	Vridha	Atapa –Summer

Sarpa	Dosha	Guna	Visha Vruddhi Vaya	Visha Vruddhi Kala
Darvikara	Vata	Ruksha Katu	Tarunya	Vrishti
Mandali	Pitta	Amla Ushna	Madhya (A:H) Vridha Vayas (Su, Ma Ni, Cha)	Seetha
Rajila	Kapha	Svadu Sitala	Vridha (A:H) Madhya Vaya (Su, Ma Ni, Cha)	Atapa

लालास्राव	Salivation
फेनागमनं	Emitting of Froth
स्रोतो अवरोधा	Obstruction of Channels

Mandali Visha Lakshana

मण्डलिविषेण त्वगादीनां पीतत्वं शीताभिलाषः
परिधूपनं दाहस्तृष्णा मदो मूर्च्छा ज्वरः शोणितागमन-
मूर्ध्वमधश्च मांसानामवशातनं श्वयथुर्दशकोथः
पीतरूपदर्शनमाशुकोपस्तस्ताश्च पित्तवेदना भवन्ति ।

(Su. Ka. 4/37)

त्वगादीनां पीतत्वं	Yellowish discolouration of skin
परिधूपनं	Local burning sensation
दाहस्तृष्णा	Burning sensation of body
शीतभिलाष	Desire to coldness
मद मूर्च्छा	Fainting
ज्वर	Fever
शोणितागमनम्	Bleeding from nostrils and anus
ऊर्ध्व अध	
मांसनमवशातनं	Muscles putrefied
श्वयथु	Swelling
दश कोथ	Putrefaction of site of bite
पीतरूपदर्शन	Person sees all things yellow
आशुकोप	Person become angry quickly
पीतवेदन	Yellowish discolouration of skin

Rajila visha lakshana

राजिमद्विषेण शुक्लत्वं त्वगादीनां शीतज्वरो रोमहर्षः
स्तब्धत्वं गात्राणामादंशशोफः सान्द्रकफप्रसेकश्छर्दि-
भीक्ष्णमक्ष्णोः कण्डूः कण्ठे श्वयथुर्धुरक उच्छ्वासनि-
रोधस्तमःप्रवेशस्तास्ताश्च कफवेदना भवन्ति ।

(Su. Ka. 4/37)

त्वगादीनां शुक्लत्वं	White discolouration of skin
शीतज्वरं	Fever
रोमहर्ष	Horripilations
स्तब्धत्वं गात्राणं	Stiffness of body
दंश शोफ	Swelling of bite site
सान्द्र कफ प्रसेक	Excessive discharge of thick mucus
छर्दि	Vomiting
अक्ष्णो कण्डू	Itching of eyes

कण्ठ श्वयथु	Swelling in the throat
धुरुरक	Sound in the throat
उच्छ्वास निरोध	Difficulty in breathing
तमप्रवेश	Darkness of eye
कफवेदन	Diseases due to kapha

Snakes Visha vega Lakshana and Chikitsa Darvikara visha vega lakshana

पूर्वं दर्वीकृतां वेगे दुष्टं श्यावीभवत्यसृक् ।
श्यावता तेन वक्त्रादौ सर्पन्तीव च कीटकाः ॥
द्वितीये ग्रन्थयो वेगे, तृतीये मूर्ध्नि गौरवम् ।
दृग्रोधो दंशविक्लेदश्चतुर्थे णीवनं वमिः ॥
सन्धिविश्लेषणं तन्द्रा पञ्चमे पर्वभेदनम् ।
दाहो हिध्मा च, षष्ठे तु हृत्पीडा गात्रगौरवम् ॥
मूर्च्छाऽविपाकोऽतिसारः, प्राप्य शुक्लं तु सप्तमे ।
स्कन्धपृष्ठकटीभङ्गः सर्वचेष्टानिवर्तनम् ॥

(A.H.U. 36/19-22)

Vega	Lakshana
1 st vega Affects Rakta Dhaatu	असृक् श्यावत - Bluish Blood श्याव वक्त्रत्वम् - Mouth become bluish कीटका सर्पन्ति - Formication
2 nd vega	ग्रन्थि - Appearance of enlarged glands
3 rd vega	मूर्ध्नि गौरवम् - Heaviness of head दृक् रोध - Eye sight problem दंश विक्लेद - Moistness of site of bite
4 th vega	णीवन - Spitting वमि - Vomiting सन्धि विश्लेषण - Loose joint
5 th vega	पर्व भेदन - Cutting pain in the joints दाह - Burning sensation हिध्म - Hiccup
6 th vega	हृत्पीडा - Pain in heart गात्रगौरवम् - Heaviness of the body मूर्च्छा - Fainting अविपाक - Indigestion अतिसार - Diarrhoea
7 th yoga affecting Sukra dhatu	स्कन्ध पृष्ठ कटि भङ्गः - Cutting pain चेष्टा निवर्तनं - Immobility

Darvikara visha vega chikitsa

अथ दर्वीकृतां वेगे पूर्वं विस्त्राव्य शोणितम् ।
 अगदं मधुसर्पिर्भ्यां संयुक्तं त्वरितं पिबेत् ॥
 द्वितीये वमनं कृत्वा तद्वदेवागदं पिबेत् ।
 विषापहे प्रयुञ्जीत तृतीयेऽञ्जननावने ॥
 पिबेच्चतुर्थे पूर्वोक्तां यवागूं वमने कृते ।
 षष्ठपञ्चमयोः शीतैर्दिग्धं सिक्तमभीक्ष्णशः ॥
 पाययेद्वमनं तीक्ष्णं यवागूं च विषापहैः ।
 अगदं सप्तमे तीक्ष्णं युज्यादञ्जननस्ययोः ॥
 कृत्वाऽवगाढं शस्त्रेण मूर्ध्नि काकपदं ततः ।
 मांसं सरुधिरं तस्य चर्म वा तत्र निक्षिपेत् ॥

(A.H.U. 36/74-78)

Vega	Chikitsa
1 st vega	शोणितं विस्त्रावणं – Blood letting अगद पानं – Mix with madhu and honey.
2 nd vega	वमनं कृत्वा – Vomiting therapy अगद पानं
3 rd vega	विषहर अञ्जन and नस्य
4 th vega	वमन and विषहर संसर्जन क्रम should be done.
5 th vega & 6 th vega	He should be sprinkled with cold water. Strong emetics and विषहर यवागु
7 th vega	तीक्ष्ण अगद – strong agada अञ्जन & नस्य शस्त्रेण मूर्ध्नि काकपदं कृत्वा – deep incision in the shape of crow foot on the head of the patient and medicines are placed.

Mandali visha vega lakshana

अथ मण्डलिदष्टस्य दुष्टं पीतीभवत्यसृक् ।
 तेन पीताङ्गता दाहो, द्वितीये श्वयथूद्भवः ॥
 तृतीये दंशविक्लेदः स्वेदस्तृष्णा च जायते ।
 चतुर्थे ज्वर्यते, दाहः पञ्चमे सर्वगात्रगः ॥

(A.H.U.36/23-24)

Vega	Lakshanas
1 st vega	पीतीभवत्यसृक् - Blood becomes yellow पीताङ्गता - Body full yellow दाह - Burning sensation
2 nd vega	श्वयथु - Swelling

Vega	Lakshanas
3 rd vega	दंशविक्लेद - Moist bite site स्वेद - Sweating तृष्णा - Burning sensation
4 th vega	ज्वरं - Fever
5 th vega	दाह सर्वगात्रत - Burning sensation of whole body

Mandali visha Management

तृतीये वमितः पेयां वेगे मण्डलिनां पिबेत् ।
 अतीक्ष्णमगदं षष्ठे गणं वा पदमकादिकम् ॥

(A.H.U. 36/79)

Vega	Chikitsa
1 st vega and 2 nd vega	Similar to Darvikara Sarpa visha chikitsa
3 rd vega	Peya consumed after Vomiting
4 th & 5 th vegas	Same as Darvikara Sarpa
6 th vega	Administration of padmakadi gana

Rajila visha vega lakshana

दष्टस्य राजिलैर्दुष्टं पाण्डुतां याति शोणितम् ।
 पाण्डुता तेन गात्राणां, द्वितीये गुरुताऽति च ॥
 तृतीये दंशविक्लेदो नासिकाक्षिमुखस्रवाः ।
 चतुर्थे गरिमा मूर्ध्नी मन्यास्तम्भश्च पञ्चमे ॥
 गात्रभङ्गो ज्वरः शीतः । (A.H.U. 36/25-26)

1 st vega	पाण्डु गात्रता - Paleness of body पाण्डु शोणित - Paleness of blood
2 nd vega	गुरुत्वं Heaviness
3 rd vega	दंशविक्लेद - Slimy bite site नासिकाक्षिमुखस्रवा - Secretions from nostrils, eyes and mouth
4 th vega	गरिमा मूर्ध्नि - Heaviness of head मन्यास्तम्भ - Stiffness of neck
5 th vega	गात्र भङ्गः - Breakage of body शीत ज्वर - Fever at night
6 th and 7 th vegas	like darvikara and mandala

Rajila visha vega Management

अद्योऽवगाढं प्रच्छाय वेगे दष्टस्य राजिलैः ।
 अलाबुना हरेद्रक्तं पूर्वच्चागदं पिबेत् । (A.H.U. 36/80)

Rajila Visha Vega Chikitsa

Vega	Lakshana
1 st Vega	प्रछान and रक्तमोक्षण should be done with <i>Alaabu</i>
2 nd , 3 rd , 4 th , 5 th Vega	Similar to Darvikara
6 th vega	तीक्ष्ण अञ्जन अवपीड नस्य
7 th vega	Like Darvikara Sarpa Chikitsa

Sarpa visha chikitsa

Sarpa visha chikitsa is classified as

1. Samanya chikitsa
2. Vissha chikitsa/veganusara chikitsa

Savisha nirvisha lakshana/(visha present or not)

तुद्यते सविषो दंशः कण्डूशोफरुजान्वितः ।

दह्यते ग्रथितः किञ्चिद्विपरीतस्तु निर्विषः ॥

(A.H.U. 36/18)

Bite containing poison has pricking pain, itching, swelling, pain, burning sensation, and knotted; opposite of these are features of bite not containing poison.

Samanya Sarpa Visha Chikitsa

Chaturvimshati upakrama by Charaka are coming under this. The treatment for poison should be done very quickly to save the life of the person. This is because:

मात्राशतं विषं स्थित्वा दंशे दष्टस्य देहिनः ॥

देहं प्रक्रमते धातून् रुधिरादीन् प्रदूषयेत् ।

एतस्मिन्नन्तरे कर्म दंशस्योत्कर्तनादिकम् ॥

कुर्याच्छीघ्रं यथा देहे विषवल्ली न रोहति ।

(A.H.U. 36/39-40)

The poison remains for a period of one hundred matra only at the site of the bite, and the spread throughout the body vitiating the blood and other tissues. Within this period itself, incising the site of the bite and other treatments should be done quickly so that the creeper of poison does not grow in the body.

Arishtabandha

दंशस्योपरि बध्नीयादरिष्टां चतुरङ्गुले ।

क्षौमादिभिर्वेणिकया सिद्धैर्मन्त्रैश्च मन्त्रवित् ॥

अम्बुवत् सेतुबन्धेन बन्धेन स्तभ्यते विषम् ।

न वहन्ति सिराश्चास्य विषं बन्धाभिपीडिताः ॥

(A.H.U. 36/42-43)

Arishta (tourniquet) should be tied 4 angulas (finger breadth) above the bite site with the rope of flax etc. and then fortified by potent hymns by those skilled in it. By this the poison stops spreading just as the flow of water from the dam. Blood vessels do not transport the poison, being subjected to pressure by the binding.

Nishpidana

निष्पीड्यानुद्धरेदंशं मर्मसन्ध्यगतं तथा ।

न जायते विषाद्वेगो बीजनाशादिवाङ्कुरः ॥

(A.H.U. 36/44)

After arishta bandhana, the site of bite should be massaged and the teeth (fangs) removed from the places other than the vital spots. If doing like this, poisoning does not develop just as the sprout from the destruction of the seed.

Dahana

दंशं मण्डलिनां मुक्त्वा पित्तलत्वादथापरम् ।

प्रतप्तैर्हमलोहाद्यैर्देहाशूलमुकेन वा ॥

करोति भस्मसात्सद्यो वह्निः किं नाम तु क्षतम् ।

(A.H.U. 36/45)

Except in the bite of mandali snakes which possess qualities of pitta, in the bite of all other snakes the site of the bite should be burnt with heated rods of gold, iron, etc. or even by burning charcoal. Fire turns everything into ash, what to say of a wound (even that is burnt away along with poison).

Achushana

आचूषयेत् पूर्णवक्त्रो वा मृद्भस्मागदगोमयैः ॥

प्रच्छयान्तररिष्टायां मांसलं तु विशेषतः ।

अङ्गं सहैव दंशेन लेपयेदगदैर्मुहुः ॥

चन्दनोशीरयुक्तेन सलिलेन च सेचयेत् ।

(A.H.U. 36/46-47)

Incision should be made in between two tourniquets and blood sucked through the mouth filled earlier with mud, ash, anti-poisonous drugs or cowdung; this should be done specially in mamsa (fleshy) part. The bitten part should be applied with the paste of anti-poisonous drugs again and again and washed with the water added with chandana and usira.

Sira vyadhana

विषे प्रविस्ते विध्येत्सिरां सा परमा क्रिया ।

रक्ते निर्हियमाणे हि कृत्स्नं निर्हियते विषम् ॥

(A.H.U. 36/48-49)

When the poison has spread in the body, the vein should be cut (and the blood let out). This is the best treatment when the vitiated blood is taken out, the poison also comes out.

After siravyadhana lepa and seka (application and bathings) using cold medicaments.

Hridayavarana

विषं कर्षति तीक्ष्णत्वाद् हृदयं तस्य गुप्तये ॥

पिबेद्घृतं घृतक्षौद्रमगदं वा घृताप्लुतम् ।

हृदयावरणे चास्य श्लेष्मा हृद्युपजीयते ॥

(A.H.U. 36/53-54)

Because of penetrating action, poison weakens the heart. In order to protect it the patient should drink either ghee, or mixture of ghee and honey or anti-poisonous recipe mixed with ghee; by this Hridayavarana, shleshma gets increased in the heart.

प्रवृत्तगौरवोत्क्लेशहृल्लासं वामयेत्ततः ।

द्रवैः काञ्जिककौलत्थतैलमद्यादिवर्जितैः ॥

वमनैर्विषहृदिभश्च नैव व्याप्नोति तद्वपुः ।

(A.H.U. 36/55-56)

When the patient feels heaviness, salivation and nausea, he should be made to vomit using liquid emetics avoiding kanjika

(fermented gruel), kulathayusa (soup of horse gram), taila, madya and things which are anti-poisonous. By this, the poison does not spread all over the body.

Specific Yogas for Sarpavisha

Darvikara sarpa visha specific yogas.

1. Sinduvaaraadi kashaya

सिन्दुवारितमूलानि श्वेता च गिरिकर्णिका ॥

पानं दर्वीकरैर्दष्टे नस्यं मधु सपाकलम् ।

(A.H.U.36/57-58)

Fresh juice of roots of sinduvaara and shvetagirikarnika should be consumed in case of bite by hooded snake and pakala (kushtha) mixed with honey should be used as nasal drops.

2. Tanduliyakadi agada

तन्दुलीयककाश्मर्यकिणिहीगिरिकर्णिकाः ।

मातुलुङ्गी सिता शेलुः पाननस्याञ्जनैर्हितः ॥

अगदः फनिनां घोरे विषे राजिमतामपि ।

(A.H.U. 36/60-61)

Tanduliyaka, kasmarya, kinihi, girikarnika, matulungi, sita, selu – these are used for drinking, nasal drops, and collyrium is an agada (antipoisonous remedy) for powerful poisons of darvikara snakes and also for rajimanta.

Mandala sarpa visha specific yogas

1. Sugandhyaadi agada

समाः सुगन्धामृद्वीकाश्वेताख्यागजदन्तिकाः ॥

अर्धांशं सौरसं पत्रं कपित्थं बिल्वदादिमम् ।

सक्षौद्रो मण्डलिविषे विशेषादगदो हितः ॥

(A.H.U. 63/62)

Equal parts of each of sugandha, mridvika, shveta and gajadantika, half parts of each of surasa leaves, kapitha vilwa dadima made into a paste and used, mixed with honey is an agada especially for poison of mandala snakes.

2. Himavaan agada

पञ्चवल्कवरायष्टी नागपुष्पैलवालुकम् ।
जीवकर्षभगौ शीतं सिता पद्मकमुत्पलम् ॥
सक्षौद्रो हिमवान्नाम हन्ति मण्डलीनां विषम् ।
लेपाच्छ्वयथुवीसर्पविस्फोटज्वरदाहहा ॥

(A.H.U. 36/63-64)

Panchavalkala, vara, yashti, nagapushpa, elavaluka, jivaka, shabhaka, sita, padmaka, and utpala made into a paste and is used internally mixed with honey known as himavan agada, it cures poison of mandala snake. When applied externally, it cures swelling, herpes, vescicles, fever and burning sensation.

3. Kashmaryadi agada

काश्मर्यं वटशुङ्गानि जीवकर्षभकौ सिता ।
मञ्जिष्ठा मधुकं चेति दष्टो मण्डलिना पिबेत् ॥

(A.H.U.36/65)

The person bitten by mandali snake should drink the decoction of kashmarya vatashunga, jivaka, rishabhaga, sita, manjishta and madhuka.

Rajila sarpa visha Chikitsa specific yogas

कटुकातिविषाकुष्ठगृहधूमहरेणुकाः ॥
सक्षौद्रव्योषतगरा घ्नन्ति राजिमतां विषम् ।

(A.H.U. 36/67)

Katuka, Ativisha, Kushtha, Grihadhuma, Harenuka, Vyosha and Tagara are made into paste and consumed along with honey, which destroys all poisons related with Rajila snakes.

Generally applied Yogas

Sarvakarmika agada

करवीरार्ककुसुम मूललाङ्गलिकाकणाः ॥
कल्कयेदारनालेन पाठामरिचसंयुतः ।
एष व्यन्तरदष्टानामगदः सार्वकर्मिकः ॥

(A.H.U. 36/70-71)

Flowers and roots of karaveera, arka, langali and kana along with patha and maricha are made into a paste with fermented rice wash

and consumed. The sarvakarmika agada is best for bites of vyantara sarpa.

Ashtanga agada

वंशत्वग् बीज कटुका पाटलीबीजनागरम् ।
शिरीषबीजातिविषे मूलं गावेधुकं वचा ॥
पिष्टो गोवारिणोऽष्टाङ्गो हन्ति गोनसजं विषम् ।

(A.H.U. 36/66)

Bark and seeds of vamsa katuka, seeds of patali nagara, seeds of shirisha ativisha, roots of gavedhuka and vacha macerated cow's urine (are made into paste). This is known as ashtanga agada. It kills the poisons of hybrid variety of snake gonasaja.

Contemporary View

Snake Bite

There are more than 2000 varieties of snakes identified in the world, out of which only less then 100 species are poisonous. That means the majority of snakes are non-poisonous.

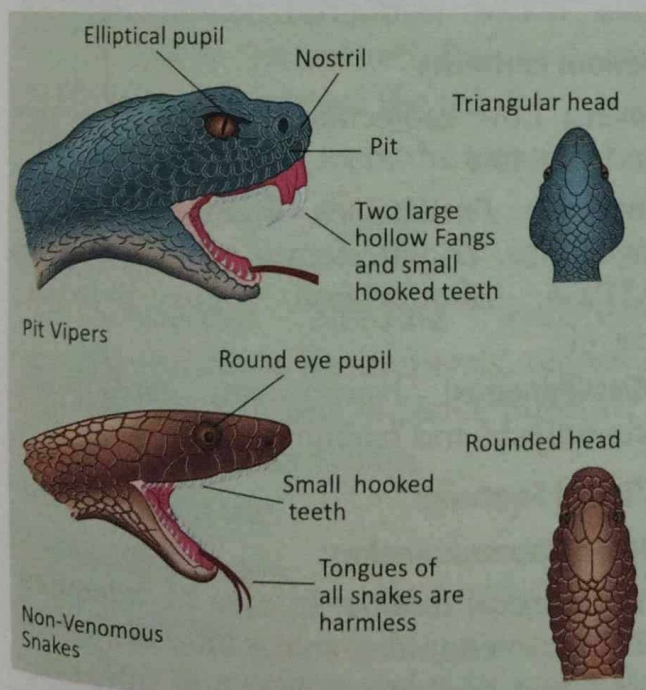
Snakes come under reptilia and have no limbs and are elongated carnivores. They are cold blooded and usually oviparous-ovoviviparous.

A snake tracks its prey using smell, collecting airborne particles with its forked tongue, then passing them to the vomero nasal organ or Jacobson's organ in the mouth for examination. The fork in the tongue provides a sort of directional sense of smell and taste simultaneously. The underside of the snake is very sensitive to vibration allowing the snake to detect approaching animals by sensing faint vibrations in the ground. Snake's visual perception varies from species to species which is adequate to detect movements. The skin of a snake is covered with scales. Belly scales help to grip on the surface while moving. The shape, and number of scales on the head, back,

and belly are characteristics often used for taxonomic purposes.

Scales are the most important feature to distinguish between poisonous and non-poisonous snakes. Here are the differences between poisonous and non-poisonous snakes.

Characters	Venomous snakes	Non-venomous snakes
Belly scales	Large, cover entire breadth of belly	Small, do not cover entire breadth of belly
Scales in the head	Usually small	Usually large
Fangs	Hollow	Short and solid
Tail	Compressed	Blunt (not so compressed)
Habits	Nocturnal	Nocturnal
Bite marks	Two fangs marks and marks sometimes of non-poisonous teeth can also be seen	Two fangs marks + marks of other small teeth



Classification of snakes on the basis of toxicity of venom:

1. Neurotoxic:

❖ Elapidae:

- Cobra: Both common cobra (*naja naja*) and king cobra (*naja hannah*)
- Krait: Common krait (*bungarus caeruleus*) and banded krait (*bungarus fasciatus*).
- Coral snake

❖ Colubridae

- Rat snake
- Tree snake
- Mountain racer

2. Vasculotoxic: (Viperidae)

- Russels viper
- Saw scaled viper
- Pit viper
- Rattle snakes

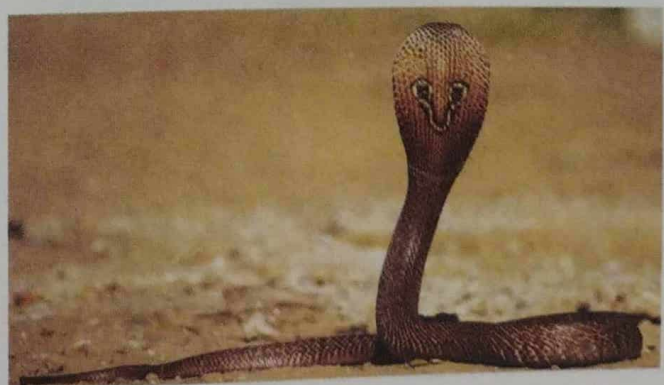
3. Myotoxic (Sea snakes)

The big four snakes: There are 4 very important snakes responsible for most of the snake bite cases occurred in India. They are

- ❖ Common cobra (neurotoxic)
- ❖ Common krait (neurotoxic)
- ❖ Russels viper (vasculotoxic/haemotoxic)
- ❖ Saw scaled viper (vasculotoxic/haemotoxic)

Some Morphological Characteristics:

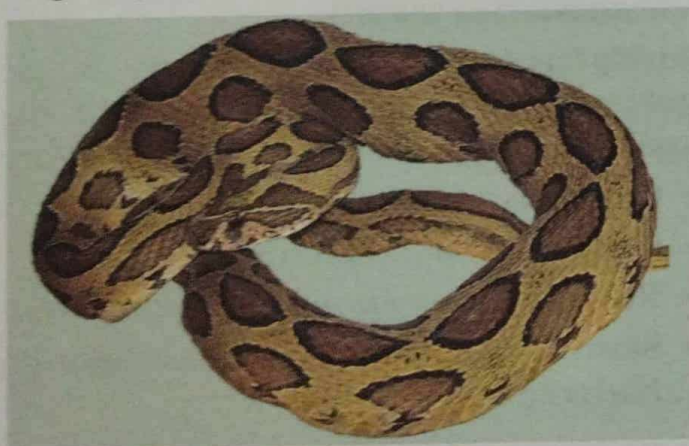
Common cobra: This snake has Large scales on head, presence of a hood with spectacle mark; 3rd supra-labial shield touches eye and nose shield and relatively small fangs which are grooved.



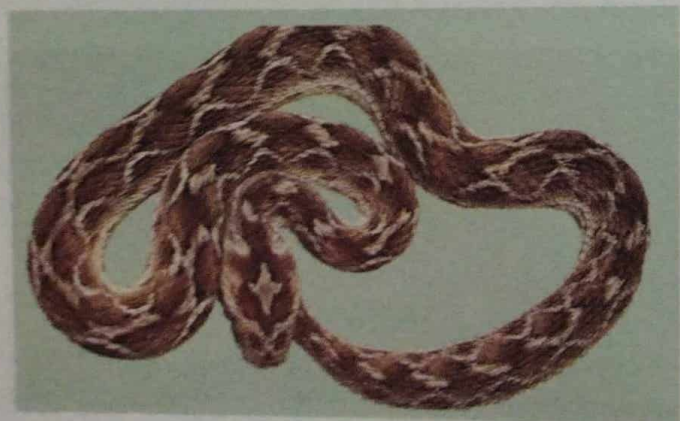
Common Krait: This Snake has bands or half rings on the back, central row of scales on back hexagonal and enlarged; scales on under surface of tail (sub-caudates) undivided; 4th infra-labial is the largest of the infra-labials and relatively small fangs.



Russels viper: This snake has triangular head with small scales; V mark on the head with apex pointing forwards; 3 rows of diamond shaped patches on the back and relatively long fangs which are channelized.



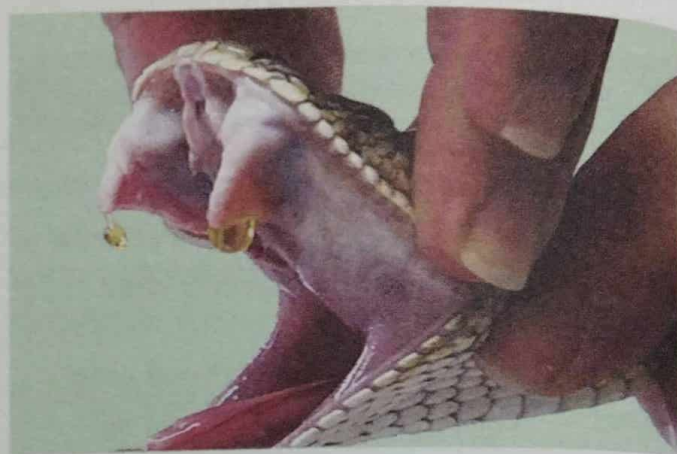
Saw scaled Viper: This snake has triangular head with small scales; white arrow mark on the head; wavy line on each flank; scales of body serrated and relatively long fangs which are channelised.



Important facts

Venom

Snake venom is toxic saliva secreted by modified parotid gland of a venomous snake. It is a clear amber colour fluid when it is fresh.



Amount of Venom per bite:

Snake	Lethal dose	Approximate amount of venom per bite	Fatal period
Krait	6 mg	8-20 mg	18 hours
Saw scaled viper	8 mg	20-30 mg	5 days
Cobra	12 mg	170-300 mg	8 hours
Russels viper	15 mg	130-250 mg	3 days

Venom contents

Toxins: Low molecular weight peptidases and proteins

Enzymes: Proteinases, hydrolases, hyaluronidase, cholinesterase, phospholipase, ATPase, ribonuclease, deoxyribonuclease, etc.

Miscellaneous: Neurotoxin, cardiotoxin, haemolysin and haemorrhagins

Clinical Features

Non-poisonous snakes:

Psychological trauma: In case of venomous and non-venomous snake bite, the person has a fear and apprehension of sure, rapid and unpleasant death.

❖ Palpitation

- ❖ Rapid and shallow breathing
- ❖ Hypotension
- ❖ Transient pallor
- ❖ Sweating
- ❖ Cold clammy skin
- ❖ Vomiting

Neurotoxic snakes: Elapidae (Cobra bite, Krait bite)

Local symptoms: In case of neurotoxic poison, poisons are minimal compared to vasculotoxic poison. There will be (a) fang marks with minimal swelling and (b) blood stained fluid oozing out.

Systemic Symptoms:

- ❖ **Pre-paralytic stage:** Vomiting, headache, and loss of consciousness.
- ❖ **Paralytic stage:** Ptosis (drooping of eyelids), ophthalmoplegia, drowsiness, dysarthria, dysphagia, convulsion, bulbar paralysis and respiratory failure.

Vasculotoxic Snakes: Viperidae (Vipers)

❖ **Local features:**

- Rapid swelling with discolouration and blister formation which may extend to the entire bitten limb and sometimes involve the trunk.
- Frank bleeding from the bite site.
- Severe pain

❖ **Systemic features:**

- Generalised bleeding tendencies like epistaxis, haemoptysis, bleeding gum, haematuria, malena, purpuric/bleeding spots in skin.
- Renal failure

Hydrophidae snakes

❖ **Local features**

- Minimal swelling and pain
- Frank bleeding from the bite site
- Severe pain

❖ **Systemic features**

- Myalgia, muscle stiffness, myoglobinuria and renal tubular necrosis.
- Renal failure

Diagnosis of snake bite

1. Fang marks

- In case of normal snake bite, there should be 2 bite marks which are separated by a distance of 8 mm-4cm depends on the bite and width of the snake's mouth.
- In case of side swipe, only one bite mark can be seen.
- Multiple bite of poisonous snake bite causes multiple bite marks.

2. Identification of Snake: This is possible in cases where victim/or his attendants bring with them the body of snake involved.

3. Laboratory investigations:

• **Haematological:**

1. Anaemia
2. Leucocytes
3. Thrombocytopenia
4. Prolonged bleeding time and clotting time.
5. Depressed fibrinogen levels.

• **ECG**

1. Common ECG changes include bradycardia, with ST elevation or depression.
2. Hyperkalaemia
3. Hypoxaemia

• **Urine**

1. Haematuria
2. Proteinuria
3. Haemoglobinuria
4. Myoglobinuria

• **Renal:** In acute renal failure.

Management in Snake bite

1. First aid measures
2. Hospital management

First aid measures:

Aim: The aim is to retard systemic absorption of venom and preserve life and prevent complications before getting medical care.

1. **Reassurance:** The bitten person should be told continuously that all snakes are not poisonous, most of the bites are non-venomous to reduce his anxiety and fright. Fear increases the sympathetic drive and increases the heart drive and thereby increases the circulation and spread of venom.
2. **Remove:** Jewellery / watch / ring / bracelet
3. **Arrange:** Rapid transport to the hospital where anti-snake venom is available.
4. **Immobilisation of the limb:** By using splint or sling to reduce the spread of person.
5. **Do it 'RIGHT' approach:** (Reassurance, Immobilise, Get to the Hospital immediately and Tell the doctor about signs and symptoms).

Dont's

- ❖ Wash (do not wash with soap or any antiseptic solution)
- ❖ Sterile dressings
- ❖ Local incision – may end up into gangrene
- ❖ Suction
- ❖ Electric currents
- ❖ Food or drinks especially alcohol which increases the rate of spread of poison
- ❖ Tourniquet not advised

But can do:



Pressure immobilisation techniques/ Sutherland wrap: It is not recommended nowadays, there is a high risk of arterial compression chances are there. It may also lead to tight local compression, loss of functions of limb or even amputation. It is still recommended in neurotoxic bite cases where local tissue damages are less.

Method: Entire limb is wrapped immediately, with a crepe/elastic bandage over the bitten area and also including the entire limb, helps to immobilise and restrict lymphatic drainage, thus helps to reduce the systemic absorption of the venom especially neurotoxic poison.

Hospital measures:

Observe the patient for at least 24 hours before discharging

Monitor: Pulse rate, respiratory rate, blood pressure, WBC count urine output, blood urea creatinine, vomiting diarrhoea, abnormal bleeding, local swelling, necrosis, ECG and blood gas analysis.

Antivenom therapy:

Indications: ASV is administered not as a routine treatment as it is associated in so many complications.

Severe local swelling, tender local regional lymphadenopathy, hemostatic abnormalities (bleeding from gums, nose, skin, etc).

Making of ASV

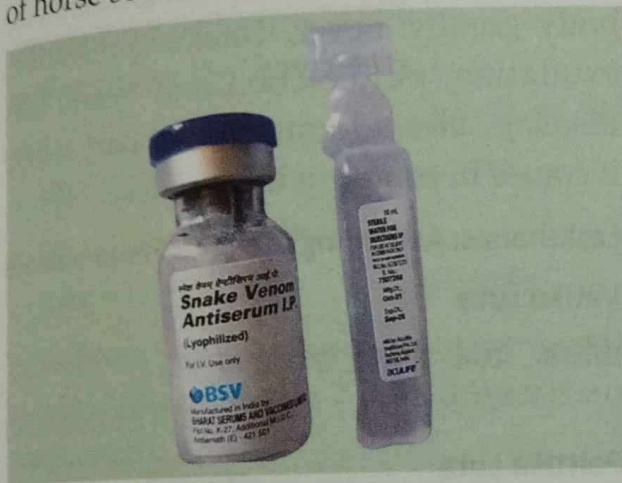
ASV is produced by injecting animals (horse or sheep, horse more common) with venom of the snakes. Once the animals develop antibodies that blood is collected and antibodies are isolated for ASV.

- ❖ **Monovalent/Monospecific:** Acts against a particular snake bite, not commonly used in India.
- ❖ **Polyvalent (Polyspecific):** Venom prepared acts against more than one species of

snakes. In India, it's commonly used against big 4 snakes.

This is prepared by Haffkin's Biopharmaceuticals Co. Mumbai, Vins Bio Products Ltd, Telangana, Bharat Serums & Vaccines Ltd, Mumbai, and Central Research Institute, Kasauli.

It is available in 10ml vial/ampule in the form of lyophilized (drying it in frozen state under vacuum) and powder of horse serum.



Market sample: Combo pack contains:

- ❖ A vial of snake ASV,
- ❖ An ampule of 10 ml sterile water.

Hypersensitivity reactions of ASV:

1. **Early:** (Anaphylaxis) urticarial, vomiting, dyspnea, laryngeal oedema, bronchospasm, hypotension, tachycardia and rigors. In this situation, administer adrenalin (epinephrine).

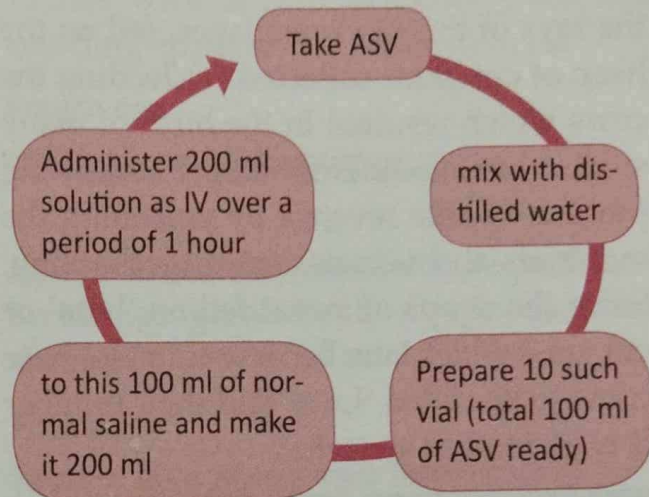
2. **Late:** Serum sickness, typically develops in 1 or 2 weeks after ASV administration with myalgia, arthralgia, fever, chills, urticarial, urticarial, lymphadenopathy or renal or neurological functions.

ASV administration should be as early as possible and as fast as possible. It should be same dose for children, adult and pregnant ladies because snake injects same amount of venom in all persons.

Route of administration of ASV: Only through IV route, no local injections, no IM is advised (poor bio availability).

ASV Administration

Dose: Usually ASV administration starts with 10 vials, check for the signs if it does not improve, administer another 10 vial, most of the times 20 vials are sufficient. However, in russels viper bite cases 30 vials required.



Post-mortem appearance in Snake bite:

- ❖ **Fang marks:** Mostly 2 bite marks (deeper in viperidae), magnifying lens can be used to detect.
- ❖ Internal organs are congested.
- ❖ **Elapidae:** Local changes minimal, brain congested.
- ❖ **Viper bite:** Swelling and cellulitis, petechial haemorrhages will be seen on visceral pleura and endocardium, regional lymph nodes are swollen, congested and haemorrhagic.

11.2 Luta Visha

Origin of Luta

विश्वामित्रो नृपवरः कदाचिदृषिसत्तमम् ।
 वशिष्ठं कोपयामास गत्वाऽऽश्रमपदं किल ॥
 कुपितस्य मुनेस्तस्य ललाटात् स्वेदबिन्दवः ।
 अपतन् दर्शनादेव रवेस्तत्समतेजसः ॥
 तृणे महर्षिणा लूने धेन्वर्थं संभृतेऽपि च ।
 ततो जातास्त्विमा घोरा नानारूपा महाविषाः ।
 अपकाराय वर्तन्ते नृपसाधनवाहने ॥
 यस्माल्लूनं तृणं प्राप्ता मुनेः प्रस्वेदबिन्दवः ।

तस्माल्लूतेति भाष्यन्ते सङ्ख्यया ताश्च षोडश ॥

(Su.Ka. 8/90-93)

On a certain occasion, Viswamitra, the Great King, went to the hermitage of the angered Vasishta, the noblest of the sages, and somehow provoked his wrath, consequently drops of sweat resembling the rays of the sun in valiance, fell on the heap of cut grass collected for feeding the cows which resulted in the birth of many spiders having different shapes and strong poisons to take revenge by poisoning the materials and vehicles used by the king. Since the drops of sweat fell on 'luna' or cut grass which later become animals, these came to be called 'Luta' and their number is explained as sixteen.

कृच्छ्रसाध्यास्तथाऽसाध्या लूतास्तु द्विविधाः स्मृताः ।

तासामष्टौ कृच्छ्रसाध्या वर्ज्यास्तावत्य एव तु ॥

(Su.Ka. 8/94)

कृच्छ्रसाध्य लूत -16 in number

असाध्य लूत -16 in number

Number of Luta

तीक्ष्णमध्यावरत्वेन सा त्रिधा हन्त्युपेक्षिता ।

सप्ताहेन दशाहेन पक्षेण च परं क्रमात् ॥

तीक्ष्ण लूत - Kills person by 7 days

मध्यम लूत - Kills person by 10 days

अवर लूत - Kills person by 15 days

कीटेभ्यो दारुणतरा लूता

Luta is more powerful than any other kita and are said to be of 16 kinds.

Some other says it: As 28 types

Some others opinion: It is innumerable

According to Doshabheden: Vatika, Pittaja, Kaphaja and Sannipatika Lutas are present

Lakshanas

सामान्य लूता दंश लक्षणम् ।

लूतादंशस्य सर्वोपि ददुमण्डलसन्निभः ॥

सितोऽसितोऽरुणः पीतः श्यावो वा मृदुरुन्नतः ।

मध्येकृष्णोऽथवा श्यावः पर्यन्ते जालकावृतः ॥

विसर्पवांश्छोफयुतस्तप्यते बहुवेदनः ।

ज्वराशुपाकविकलेदकोथावदरणान्वितः ॥

क्लेदेन यत्स्पृशत्यङ्गं तत्रापि कुरुते व्रणम् ।

(A.H. 37/55-56)

ददु मण्डल - Site develops swelling like dadru mandala which is white, blackish, red, yellow or blue in colour, soft elevated black or blue in the centre and sieve like edges. Swelling spreads side-wards, torments the body greatly. Fever, quick suppuration, exudation, putrefaction and tissue loss develop, ulcers forms on that part where it comes in contact with the pus.

Lakshanas: According to Dosha Predominance

Vatika Luta

वातिकः परुषः श्यावः पर्वभेदज्वरप्रदः ।

(A.H.U. 37/50)

Paittika Luta

तदंशः पैत्तिको दाहतृट्स्फोटज्वरमोहवान् ।

भृशोष्मा रक्तापीताभः क्लेदी द्रक्षाफलोपमाः ॥

(A.H.U. 37/48)

Kaphaja Luta

श्लैष्मिकः कठिनः पाण्डुः परुषकफलाकृतिः ।

निद्रां शीतज्वरं कासं कण्डूं च कुरुते भृशम् ॥

(A.H.U. 37/49)

Vatika	Pittaja	Kaphaja
परुष - Rough	दाह Burning sensation	Hard pale swelling
पर्वभेद - Cutting pain in joints	तृट् -Thirst	परुषक फलाकृति Resembling a fruit of Parushaka
ज्वर - Fever	स्फोट - Vesicles	निद्रां - Sleep
श्याव - Bluish colour	ज्वर -Fever	शीत ज्वरं -Cold fever
	मोह -Fainting भृशोष्मा -feeling hot	कासं -Cough

Vatika	Pittaja	Kaphaja
	रक्तपीताभ -Red, yellow colouration	कण्डू -Itching
	क्लेदि -Exudation	
	द्राक्षाफलोपम -Swelling resembling draksha	

Adhishthanas of Luta visha

श्वासदंष्ट्राशकृन्मूत्रशुक्रलालानखार्तवैः ॥

अष्टाभिरुद्धमत्येषा विषं वक्त्राद्विशेषतः ।

(A.H.U. 37/58)

- ❖ श्वास
- ❖ दंष्ट्रा
- ❖ शकृत्
- ❖ मूत्र
- ❖ शुक्ल
- ❖ लाल
- ❖ नख
- ❖ आर्तव

In Sushruta Samhita, swasa is not mentioned as adhishthana. (Only 7 adhishthanas are mentioned).

Day by day changes of Luta visha

First day

दिनार्धं लक्ष्यते नैव दंशो लूताविषोद्भवः ॥

सूचीव्यधवदाभाति ततोऽसौ प्रथमेऽहनि ।

अव्यक्तवर्णः प्रचलः किञ्चित् कण्डूरुजान्वितः ॥

(A.H.U. 37/60-61)

The lesion of spider bite does not manifest till half a day, then on the first day it appears like a mark made by a needle, without any manifestation of colour. It is very unsteady with mild itching and pain.

Second day

द्वितीयेऽभ्युन्नतोऽन्तेषु पिटिकैरिव वाऽऽचितः ।

व्यक्तवर्णो नतो मध्ये कण्डूमान् ग्रन्थिसन्निभः ॥

(A.H.U. 37/62)

On the second day, there will be elevation at the edges or numerous eruptions with well manifested colour, depressed in the centre itching and appears like tumor.

Third day

तृतीये सज्वरो रोमहर्षकृद्रक्तमण्डलः ।

शरावरूपस्तोदाढ्यो रोमकूपेषु सास्त्रवः ॥

(A.H.U. 37/ 63)

On the third day, there will be fever, horripilation, red in colour, saucer shaped, rashes with severe pricking pain and bleeding appears at the hair follicles.

Fourth day

महांश्चतुर्थे श्वयथुस्तापश्वासभ्रमप्रदः ।

(A.H.U. 37/63)

On the fourth day, there will be profound swelling, great heat, dyspnoea, and dizziness.

Fifth day

विकारान् कुरुते तांस्तान् पञ्चमे विषकोपजान् ॥

(A.H.U. 37/64)

On the fifth day, there will be many symptoms like vishakopa vikara.

Sixth day and Seventh day

षष्ठे व्याप्नोति मर्माणि सप्तमे हन्ति जीवितम् ।

(A.H.U. 37/65)

On the 6th day: It spreads to marma.

On the 7th day: It kills the person.

Luta Visha Chikitsa

1. Shastra karma and Dahana

अथाशु लूतादष्टस्य शस्त्रेणादंशमुद्धरेत् ।

दहेच्च जाम्बवौष्ठाद्यैर्न तु पित्तोत्तरं दहेत् ॥

(A.H.U. 37/ 66)

The teeth of spider should be removed with the help of knife, immediately the place should be burnt by heated stone etc. and the place which is pitta predominant should not be burnt.

2. Contraindication of Dahana and Chedana

कर्कशं भिन्नरोमाणं मर्मसन्ध्यादिसंश्रितम् ॥

प्रसृतं सर्वतो दंशं न छिन्दीत दहेन च ।

(A.H.U. 37/ 67)

The bite site which is very rough, having damaged hairs located on vital parts, bony joints etc. with copious exudation should either be cut or burnt.

3. Lepa and Sechana

लेपयेद्गन्धमगदैर्मधुसैन्धवसंयुतैः ॥

सुशीतैः सेचयेच्चानु कषायैः क्षीरिवृक्षजैः ।

(A.H.U. 37/68)

After cauterization, the place must be applied with a paste of the Agada added with honey and saindhava. Then the part bathed often with decoction of milky sap makes it very cool.

4. Raktamokshana

सर्वतोऽपहरेद्रक्तं शृङ्गाद्यैः सिरयाऽपि वा ॥

सेकलेपास्ततः शीता बोधिश्लेष्मातकाक्षकैः ।

(A.H.U. 37/69)

Blood should be let out by sucking horn etc. By cutting the vein, then the part is applied with the decoction of *Bodhi*, *Shleshmataka*, *Aksha* often and their paste in cold condition.

Line of Management

- ❖ Shashtra karma
- ❖ Dahana
- ❖ Lepana
- ❖ Bodhyaadi lepanam
- ❖ Sechana
- ❖ Rakta mokshana
- ❖ Samana oushadha

Important Yogas

- ❖ पद्मकादि अगद
- ❖ चम्पकादि अगद
- ❖ मन्दरागद
- ❖ गन्धमादन अगद
- ❖ लोध्रसेव्यादि अगद

Padmakadi Agada

फलनीद्विनिशाक्षोदसर्पिर्भिः पद्मकाह्वयः ॥

अशेषलूताकीटानामगदः सार्वकार्मिकः ।

(A.H.U. 37/70)

Phalini, harida, daru harida, honey and ghee are made into paste and rolled into pills. This known as **Padmakadi Agada**.

Champakadi Agada

हरिद्राद्वयपत्तङ्गः मञ्जिष्ठानतकेसरैः ॥

सक्षौद्रसर्पिः पूर्वस्माददिकश्चम्पकाह्वयः ।

(A.H.U. 37/71)

Haridra, Pattanga, Manjishtha, Nata, Kessara, Honey and Ghee are lived and made into pills. Called **Champaka Agada**, it is more efficacious than Padmakadi agada.

Lodhrasevyadi Agada

लोध्रं सेव्यं पद्मकं पद्मरेणुः

कालीयाख्यं चन्दनं यच्च रक्तम् ।

कान्तापुष्पं दुग्धिनीका मृणालं

लूताः सवग्निन्ति सर्वक्रियादिभिः ॥ (A.H.U. 37/86)

Lodhra, Sevy, Padmaka, Padmarenu, Rakta Chandana, Kaantaa Pushpam, Dugdhinika, and Mrinaalam are made into Kashaayam, which is called Lodhrasevyadi Kashayam. This is effective in Luta Visha and can be used as all types of formulation.

Dasavidha upakramas/ 10 Treatment Modalities

नस्याञ्जनाभ्यञ्जन पान धूमं तथाऽवपीडं कवलग्रहं च ।

संशोधनं च उभयतः प्रगाढं कुर्यात् सिरामोक्षणमेव

चात्र ॥

(Su. Ka. 8/134)

- | | | |
|------------|------------|---------------|
| ❖ नस्य | ❖ धूम | ❖ विरेचन |
| ❖ अञ्जन | ❖ अवपीड | ❖ सिरामोक्षणं |
| ❖ अभ्यञ्जन | ❖ कवल ग्रह | |
| ❖ पान | ❖ वमनं | |

Spider bite

Black widow or Hourglass spider (Latrodectus mactans)- neurotoxic



Features: Pain, (painful cramps), may be present locally, or it may radiate proximally along the affected limb.

Systemic: Nausea, vomiting, anxiety, fever, hypertension, priapism, fasciculations, paresthesia and renal failure.

❖ **Brown recluse** (violin spider) (*Loxosceles reclusa*)—cytotoxic (e.g.: sphingomyelinase).



Features: Initially bite is painless or produces, a stinging sensation but within hours becomes painful and pruritic. Cutaneous necrosis also present at bite site is characterized with blackish discolouration of skin around the bite site due to tissue death. Additionally systemic symptoms such as fever, nausea or muscle cramps also occur.

11.3 Vrishchika Visha

Origin of Vrishchika

ते गवादिशकृत्कोथाद्दिग्धदष्टादिकोत्थतः ॥

सर्पकोथाच्च सम्भूता मन्दमध्यमहाविषाः ।

(A.H.U. 37/ 7)

The scorpions are born from the putrefied, dung of cow etc., cadaver of animals killed by poisoned arrow and cadaver of snakes and are of 3 kinds—

- ❖ मन्द विष – Mild poison
- ❖ मध्य विष – Moderate poison
- ❖ महा विष – Powerful poison

Morphological Features

मन्दाः पीताः सिताः श्यावा रूक्षाः कर्बुरमेचकाः ॥

रोमशा बहुपर्वाणो लोहिताः पाण्डुरोदराः ।

(A.H.U. 37/ 8)

मन्द विष वृश्चिक लक्षण -

- ❖ पीत – Yellowish coloured
- ❖ सित – Whitish
- ❖ श्याव – Blue black coloured
- ❖ रूक्षा – Dry
- ❖ कर्बुरमेचक – Blackish or various colours
- ❖ रोमशा – Hairy
- ❖ पाण्डुरोदरा – Pale abdomen

मध्यम विष वृश्चिक

धूम्रोदरास्त्रिपर्वाणो मध्यास्तु कपिलारुणाः

पिशङ्गाः शबलाश्चित्राः शोणिताभाः । (A.H.U. 37/9)

Madhyama visha vrischika is of moderate poison, have smoke coloured abdomen, three joints, brown, slightly red, reddish brown, body spotted, variegated and resembling blood.

Tikshna visha/Maha visha Vrishchika

महाविषाः

अग्न्याभा द्रव्येकपर्वाणो रक्तासितसितोदराः ॥

(A.H.U. 37/10)

Mahaavisha vrishchikas are powerful poison, appear like fire. Having one joint, they are either red, black or white.

The Potency of visha of Vrishchika

वृश्चिकस्य विषं तीक्ष्णमादौ दहति वह्निवत् ।

ऊर्ध्वमारोहति क्षिप्रं दंशे पश्चात्तु तिष्ठति ॥

दंशः सद्योऽतिरुक् श्यावतुद्यते स्फुटतीव च ।

(A.H.U. 37/6)

The poison of the scorpion is penetrating, causes burning sensation in the beginning just like fire spreads upwards quickly and then gets stabilised, at the site of bite. There will be severe pain, blue colour, pricking and bursting pain at the site.

Samanya Lakshana

तैर्दष्टः शूनरसनः स्तब्धगात्रो ज्वरार्दितः ।
 खैर्वमन् शोणितं कृष्णामिन्द्रियार्थानसंविदन् ॥
 स्विद्यन् मूर्च्छन् विशुष्कास्यो विह्वलो वेदनातुरः ।
 विशीर्यमाणमांसश्च प्रायशो विजहात्यसून् ।

(A.H.U. 37/11-12)

Bitten by scorpion, the person develops swelling of the tongue, rigidity of the body, fever, and black coloured blood comes out from all the orifices. There will be loss of sensory perceptions, sweating, fainting, dryness of the mouth, unsound mind, suffer from discomfort, wasting of the muscles (emaciation) and even death.

Lakshana of Vrishchika - According to Dosha

हृत्पीडोर्ध्वानिलस्तम्भः शिरायामोस्थिपर्वरुक् ।
 घूर्णनोद्वेष्टनं गात्रश्यावता वातिके विषे ॥
 संज्ञानाशोष्णनिश्वासौ हृद्दाहः कटुकास्यता ।
 मांसावदरणं शोफो रक्तपीतश्च पैत्तिके ॥
 छर्द्यरोचकहृल्लासप्रसेकोत्क्लेशपीनसैः ।
 सशैत्यमुखमाधुर्यैर्विद्याच्छ्लेष्माधिकं विषम् ॥

(A.H.U. 37/17-19)

Vataja vrishchika Lakshana	Pittaja vrishchika Lakshana	Kaphaja vrishchika Lakshana
हृत्पीडा	संज्ञानाश	छर्दि
ऊर्ध्वानिल स्तम्भ	उष्णनिश्वास	अरोचक
सिरायाम	हृद्दाह	हृल्लास
अस्थिपर्वरुक्	कटुकास्यता	प्रसेक
गात्रश्यावत	मांसावदरण	उत्क्लेश
उद्वेष्टनं	शोफ	पीनसै
	रक्तपीत	मुखमाधुर्य

According to Acharya Sushruta Kalpasthana**Manda visha Vrishchika lakshana**

एभिर्दष्टे वेदना वेपथुश्च
 गात्रस्तम्भः कृष्णरक्तागमश्च ॥
 शाखादष्टे वेदाना चोर्ध्वमेति
 दाहस्वेदौ दंशशोफो ज्वरश्च । (Su.K. 8/60)

By their sting, they produce pain, trembling, stiffness in the body and out flow of black

blood. If stung at the extremities, pain rushes upwards along with burning sensation, sweating, local inflammatory swelling and fever.

Madhyama visha Vrishchika lakshana

जिह्वाशोफो भोजनस्यावरोधो
 मूर्च्छा चोग्रा मध्यवीर्याभिर्दष्टे । (Su.K.8/62)

It causes inflammation of the tongue, obstruction of food and severe fainting.

Tikshna visha Vrishchika lakshana

एभिर्दष्टे सर्पवेगप्रवृत्तिः
 स्फोटोत्पत्तिर्भ्रान्तिर्दाहो ज्वरश्च ।
 खेभ्यः कृष्णं शोणितं याति तीव्रं
 तस्मात् प्राणैस्त्यज्यते शीघ्रमेव ॥ (Su.K. 8/66)

When tikshna visha vrishchika stings, the impulse of snake-poison emerges, eruptive boils appear along with giddiness, burning sensation, fever and virulent discharge of black blood from the passage due to which the person dies soon.

Vrishchika visha Chikitsa

उग्रमध्यविषैर्दष्टं चिकित्सेत् सर्पदष्टवत् (Su.K.8/67)

Tikshna and Madhya visha Vrishchika chikitsa like Sarpa Dashta Chikitsa.

1. Taila Sechana

सद्यो वृश्चिकजं दंशं चक्रतैलेन सेचयेत् ।
 विदारिगन्धासिद्धेन कवोष्णेनेतरेण वा ॥
 लवणोत्तमयुक्तेन सर्पिषा वा पुनःपुनः
 सिञ्चेत्कोष्णारनालेन सक्षीरलवणेन वा ॥

(A.H.U. 37/29-30)

- ❖ Chakra taila sechana
 - ❖ Or sechana with vidarigandha gana/ ghee with saindhava (ghrita saindhava dhara)/aranala or kanji which is slightly hot/kshira with milk.
- (The site of scorpion bite should be bathed with or by oil boiled with vidarigandha gana or by oil boiled with slightly warm or warm ghee added with lavanothama

(saindhava lavana) or with rice gruel added with milk and salt this process repeated often).

2. Upanaha swedana

उपनाहो घृते भृष्टः कल्कोऽजाज्याः ससैन्धवः ।

(A.H.U. 37/30)

Application of warm poultice of ajaji fried in the ghee added with saindhava.

3. Pratisarana

आदंशं स्वेदितं चूर्णैः प्रच्छद्य प्रतिसारयेत् ।।
रजनी सैन्धव व्योषशिरीषफलपुष्पजैः ।

(A.H.U. 37/31)

The site of bite should be incised and then rubbed with the fine powder of rajani, saindhava, vyosha, fruits and flowers of sirisa.

4. Lepa

मातुलुङ्गाम्लगोमूत्रपिष्टं च सुरसाग्रजम् ।।

लेपः सुखोष्णश्च हितः पिण्याको गोमयोऽपि वा ।

(A.H.U. 37/32)

The flowers of tulsi made into paste with matulunga and cow's urine or pinyaaka (oil cake of tila) or fresh cow dung, may be applied warm over the site.

5. Paanam

पाने सर्पिर्मधुयुतं क्षीरं वा भूरिशर्करम् ।

Ghee mixed with honey or milk added with more sugar are good for drinking.

Important Formulations:

हिङ्वादि गुटिक

हिङ्गुना हरितालेन मातुलुङ्ग रसेन च ।

लेपाञ्जनाभ्यां गुटिका परमं वृश्चिकापहा ।

(A.H.U. 37/35)

Gutika prepared of hingu, harataala, along with juice of matulunga used for application on the bite and collyrium is best to remove the poison of scorpion.

करञ्जादि लेपं

करञ्जार्जुनशेलूनां कटभ्याः कुटजस्य च ।।

शिरीषस्य च पुष्पाणि मस्तुना दंशलेपनम् ।

(A.H.U. 37/36)

Lepana using the medicines *Karanja*, *Arjuna*, *Selu*, *Kutaja*, *Shirisha Pushpa* in *Mastu*.

नागरादि लेपं

नागरं गृहकपोतपुरीषं बीजपूरकरसो हरितालम् ।

सैन्धवं च विनिहन्त्यगदोऽयं लेपतो ऽलिकुलजं विषमाशु ।।

(A.H.U. 37/40)

Lepana done with *Naagara*, *Kapota Purisha*, *Beejapuraka Swarasa*, *Haritaala*, *Saindhava*, etc.

Scorpion bite:



All venomous scorpion bites belong to a large family: *bhuthidae*, example: *Leiurus quinquestriatus* and *mesobuthus tamulus*.

Mode of Action: Neurotoxins in the venom of scorpion affect voltage gated Na- channels and K channels.

Neurotoxin of scorpions is more lethal than neurotoxin of snake.

Clinical Features:

Local: Severe pain at the site of sting and erythema and edema around the bite site.

Systemic manifestations: It is due to action of venom on the autonomic nervous system.

They are :

- ❖ Profuse sweating
- ❖ Thin ropy salivation due to stimulation of bronchial mucous glands which is

difficult to expectorate (it persists for 2-4 hours).

- ❖ **Priapism:** It is the prolonged erection of the penis without sexual arousal- is seen in children and 20% of adults.
- ❖ **Dilatation of pupil:** (mydriasis)
- ❖ **Cold extremities:** Due to severe vasoconstriction become of liberated catecholamine.
- ❖ **CVS:** (1) Hypotension: It is short lasting due to hypovolaemia as a result of vomiting, sweating and salivation. (2) Hypertension and pulmonary oedema due to stimulation of alpha receptors.

Management

- ❖ Immobilise the limb.
- ❖ Scorpion anti-venom is a specific treatment and must be administered as early as possible through IV route.
- ❖ Other drugs like vasodilators, ACE inhibitors, anti-inflammatory and anti-allergic medicines have to be given.

11.4 Mushaka Visha and its Contemporary Relevance

मूषक विष अधिष्ठान

Vishadhishtana – शुक्रं

According to Aalambaayana – 5 Adhishtana

- ❖ शुक्रं ❖ मूत्र ❖ दंष्ट्रा
- ❖ पुरीष ❖ नख

18 in number: Number of mushaka

लालनश्चपलः पुत्रो हसिरश्चक्करोऽजिरः ।

कषायदन्तः कुलकः कोकिलः कपिलोऽसितः ॥

अरुणः शबलः श्वेतः कपोतः पलितोन्दुरः ।

छुच्छुन्दरो रसालाख्यो दशाष्टौ चेति मूषिकाः ॥

(ref: A.H.U. 38/1-2)

- | | |
|-------------|------------------|
| 1. Lalana | 6. Chuchundara |
| 2. Putraka | 7. Alasaka |
| 3. Krishna | 8. Kashaayadanta |
| 4. Hasira | 9. Kulinga |
| 5. Chikkira | 10. Ajitta |

11. Chapala
12. Kapila
13. Kokila
14. Aruna

15. Mahaa Krishna
16. Mahashveta
17. Mahaa kapila
18. Kapota

Mushaka visha lakshana

शुक्रं पतति यत्रैषां शुक्रदिग्धैः स्पृशन्ति वा ।
यदङ्गमङ्गैस्तत्रास्त्रे दूषिते पाण्डुतां गते ॥
ग्रन्थयः श्वयथुः कोठो मण्डलानि भ्रमोऽरुचि ।
शीतज्वरोऽतिरुक्सादो वेपथुः पर्वभेदनम् ॥
रोमहर्षः स्त्रुतिर्मूर्च्छा दीर्घकलानुबन्धनम् ।
श्लेष्मानुबद्धवह्वाखुपोतकच्छर्दनं सतृट् ॥

(A.H.U. 38/3-5)

The part of the body which comes in contact with their semen directly or through cloth contaminated by it, the blood becomes vitiated and pale.

- ❖ ग्रन्थयो – Small nodule
- ❖ श्वयथु – Swelling
- ❖ कोठ – Rashes
- ❖ मण्डलानि – Pigmented patches
- ❖ भ्रम – Dizziness
- ❖ अरुचि – Loss of taste/appetite
- ❖ शीतज्वर – Fever
- ❖ अतिरुक् – Severe pain
- ❖ साद – Tiredness
- ❖ वेपथु – Tremor
- ❖ पर्व भेदनं – Cutting pain in the joints
- ❖ रोमहर्ष – Horripilation
- ❖ स्त्रुति – Bleeding
- ❖ मूर्च्छा – Fainting
- ❖ दीर्घकलानुबन्धनं – Chronic disease
- ❖ श्लेष्मानुबन्ध बह्वाशु पोतक छर्दनं – Vomiting resembling small rats
- ❖ तृट् – Thirst

Asadhya lakshana of Mushaka visha

मूर्च्छाङ्गशोफवैवर्ण्यक्लेदशब्दाश्रुतिज्वराः ॥
शिरोगुरुत्वं लालासृक्छर्दिश्चासाध्यलक्षणम् ।
(A.H.U. 38/6)

- ❖ मूर्च्छा – Fainting
- ❖ अङ्गःशोफ – Swelling in the body
- ❖ वैवर्ण्य – Discolouration
- ❖ क्लेद – Exudation
- ❖ शब्दाश्रुति – Loss of hearing
- ❖ शिरोगुरुत्वं – Heaviness of head
- ❖ लालासृक्छर्दि – Vomiting saliva and blood

शूनवस्ति विवर्णोष्ठमाख्याभैर्ग्रन्थिभिश्चितम् ।
छुच्छुन्दरसगन्धं च वर्जयेदाखुदूषितम् । (A.H.U. 38/7)
Swelling of urinary bladder, discolouration of lips, body covered with nodules resembling rats, emits smell of rats etc.

Mushaka visha Chikitsa

- ❖ दहन
- ❖ प्रच्छन्न
- ❖ प्रलेपन
- ❖ अम्ल द्रव्य क्षालनं
- ❖ सिरामोक्ष
- ❖ छर्दनम्
- ❖ विरेचनं
- ❖ शिरोविरेचनं
- ❖ शमन कषाय पानं

Dahana

आखुना दष्टमात्रस्य दंशं काण्डेन दाहयेत् ।
दर्पणेनाथवातीव्ररुजा स्यात्कर्णिकाऽन्यथा ॥

(A.H.U. 38/16)

The site of bite by the rat should be burnt either by a stem of plant or a mirror, if not done so there will be severe pain and development of a round muscular growth.

Pralepana

अगारधूममञ्जिष्ठारजनीलवणोत्तमैः ॥
लेपो जयत्याखुविषं कर्णिकायाश्च पातनः ।

(A.H.U. 38/18)

Apply paste of Shirisha, Rajani, Vakra, Kunkuma, and Amrita Valli after burning the wound it should be incised with a knife.

Amladravya Kshalanam and Siravyadha

ततोऽम्लैः क्षालयित्वाऽनु तोयेरनु च लेपयेत् ॥
पालिन्दीश्वेतकटभीबिल्वमूलगुडूचिभिः ।
अन्यैश्च विषशोफघ्नैः सिरां वा मोक्षयेद्दुरुतम् ॥

(A.H.U. 38/19-20)

Next it should be washed with any sour liquid and applied with the paste of palindi, root of vilwa, and guduchi, or other drugs which destroys poison and mitigate swelling, then the vein should be cut urgently.

Vamana

छर्दनं नीलिनीक्वाथैः शूकाख्याङ्कोल्लयोरपि ।

OR

कोशातक्याः शूकाख्यायाः फलं जीमूतकस्य च ॥

मदनस्य च संचूर्णया दध्ना पीत्वा विषं वमेत् ।

(A.H.U. 38/20)

Vomiting should be produced by administration of the decoction of *nilini*, *Sukakhya* and *ankola*.

OR

Poison should be got vomited out by drinking curds, added with the powder of fruits of kosataki, Shukakhya, jimutaka and madana.

Virechana

विरेचनं त्रिवृन्नीलीत्रिफलाकल्क ईष्यते ।

(A.H.U. 38/23)

Virechana or Purgation therapy should be done by internal administration of kalka of Trivith, Nilini and Triphala.

Shirovirechana/Nasya

शिरोविरेचने सारः शिरीषस्य फलानि च ।

अञ्जनं गोमयसो व्योषसूक्ष्मरजोन्वितः ॥

(A.H.U. 38/24)

For nasya of the head, sirisha sara and phala for use as collyrium juice of fresh cow dung mixed with fine powder of vyosha are suitable.

Kashaayapaana

सिन्दुवारं नतं शिगुबिल्वमूलं पुनर्नवा ।
वचाश्वदंष्ट्राजीमूतमेषां क्वाथं समाक्षिकम् ॥

पिबेच्छल्योदनं दध्ना भुञ्जानो मूषिकार्दितः ।
तक्त्रेण शरपुङ्खाया बीजं सञ्चूर्ण्य वा पिबेत् ॥

(A.H.U. 38/27-28)

The person suffering from rat bite poison should drink the decoction of *Sinduvara*, *Nata*, *Sigru*, root of *Bilva*, *Punarnava*, *Vachaa*, *Svadamshttra*, and *Jimuta* with Honey. Boiled Salirice along with *dadhi* or drink the powder of seed of *Sarapunkha*, mixed with *Takra* (butter milk).

Contemporary View

The common diseases which are spread by rat are:

1. Hantavirus

This is most commonly found in white footed mouse, cotton rat and rice rat. The hantavirus is a potentially life threatening disease that has no specific treatment.

Symptoms include fever, fatigue, muscle aches (generally in hips, backs and thighs) and may include diarrhoea, abdominal pain, nausea and vomiting.

2. Lymphocytic choriomeningitis virus (LCMV)

The most popular host of this virus is the common house mouse. LCMV usually occurs in two stages. Firstly, it includes symptoms like nausea vomiting, headache, muscle aches and lack of appetite. The second stage is primarily more neurological and causes meningitis, encephalitis and meningocephalitis.

3. Plague

This is caused by the bacteria, *Yersinia pestis*, a zoonotic bacteria usually found in small mammals and their fleas. People infested with *Y.pestis* develop symptoms only after incubation period of 1-7 days.

2 Important clinical forms

- ❖ **Bubonic plague** – Most common and is characterised by painful swollen lymph nodes or buboes.
- ❖ **Pneumonic plague** is a severe lung infection caused by bacteria *Yersinia*

pestis, the same organism responsible for bubonic plague. It is one of the deadliest forms of plague and can spread rapidly from person to person through respiratory droplets. It can be fatal without proper diagnosis and treatment.

Plague is transmitted between animals and humans by bite of infected fleas, direct contact with infested tissues, and inhalation of infected respiratory droplets.

Plague can be a very severe disease in people with case fatality ratio 30%-60% for the bubonic type, and is always fatal for the pneumonic kind when left untreated.

Antibiotic treatment is effective against this bacteria and early diagnosis and early treatment can save the lives.

4. Salmonella

Some rodents carry salmonella bacteria in their digestive tract. Infestation occurs by eating the contaminated food. Symptoms include: chills, fever, abdominal cramps, nausea, vomiting, and diarrhoea.

5. Leptospirosis

- ❖ It is a bacterial disease that affects humans and animals. It is caused by bacteria of the genus *leptospira*.
- ❖ This bacteria that causes leptospirosis spreads through the urine of infected animals which can get into water or soil and can survive for weeks to months. Different animals including wild and domestic carry this bacteria.
- ❖ Infected animals such as cattles, pigs, dogs, rodents etc. have no symptoms but they continue to excrete the bacteria into the environment continuously.
- ❖ Humans get infection through contact with urine (or other bodily secretion except saliva) from infected animals

and contact with water, soil, or food contaminated with the urine of infected animals.

❖ The bacteria can enter the body through skin or mucus membranes (eyes, nose or nose), especially if the skin is broken from a wound or scratch. Drinking contaminated water can also cause infection.

❖ Signs and symptoms include: high fever, headache, chills, muscle aches, vomiting, jaundice, red eyes, abdominal pain, diarrhea, and rashes.

Management

Leptospirosis is treated with antibiotics such as doxycycline or penicillin which should be given early in the course of treatment.

11.5 Alarka Visha and its Contemporary Relevance

शुनः श्लेष्मोल्बणा दोषाः संज्ञां संज्ञावहाश्रिताः ॥

मुष्णन्तः कुर्वन्ते क्षोभं धातूनामतिदारुणम् ।

लालावानन्धबधिरः सर्वतः सोऽभिधावति ॥

स्वस्तपुच्छहनुस्कन्धः शिरोदुःखी नताननः ।

(A.H.U. 38/8)

Among the three doshas, kapha is predominant and gets aggravated, invades the sanjavaha srotas and produces serious disorders of the mind and tissues ardhatus in the body of the dog. The deprived or the affected animal runs here and there with dribbling of saliva, without proper vision and hearing [as sense organs affected] with dropped tail, lowered jaws and shoulders along with headache. This stage of animal causes maximum bites to humans.

उन्मत्त श्वादि दष्ट मनुष्य लक्षणम्/Signs of Infected Animal

दंशस्तेन विदष्टस्य सुप्तः कृष्णं क्षरत्यसृक् ॥

हृच्छिरोरुग्ज्वरस्तम्भतृष्णामूर्च्छोद्भवोऽनु च ।

(A.H.U. 38/10)

Bitten by such a dog, the person gets into stupor, black coloured blood flows out, pain in the heart and head, fever, rigidity of the body, thirst and fainting develops gradually.

Alarka damasa lakshana

कण्डूनिस्तोदवैवर्ण्यमुपितक्लेदज्वरभ्रमाः ॥

विदाहरागरुक्पाकशोफग्रन्थिविकुञ्जनम् ।

दंशावदरणं स्फोटाः कर्णिका मण्डलानि च ॥

सर्वत्र सविषे लिङ्गः, विपरीतं तु निर्विषे ।

(A.H.U. 38/12-13)

कण्डू	Itching
निस्तोद	Constant pain
वैवर्ण्य	Discolouration
सुप्ति	Numbness
क्लेद	Exudation
ज्वर	Fever
भ्रम	Dizziness
विदाह	Burning sensation
राग	Red colour
रुक्	Pain
पाक	Suppuration
शोफ	Swelling
ग्रन्थि	Development of tumour
दंशावदरणं	Appearance of vesicles
स्फोट	Appearance of vesicles
मण्डलानि	Round like ashes

Incurable or Asadhya lakshana

दष्टो येन तु तच्चेष्टारुतं कुर्वन् विनश्यति ॥

पश्यंस्तमेव चाकस्मादादर्शसलिलादिषु ।

(A.H.U. 38/14)

The person imitates the animal in its action and cry which has bitten him, sees them accidentally in the mirror, water, etc. and dies.

Hydrophobia (Jalasantrasa)

योऽद्भ्यस्त्रस्येददष्टोऽपि शब्दसंस्पर्शदर्शनैः

जलसन्त्रासनामानं दष्टं तमपि वर्जयेत् ।

(A.H.U. 38/15)

The person who becomes afraid of water by its sound, sight and touch even though not bitten is said as affected by Jalasantrasa and should be refused treatment or (Asadhya)

Alarka Visha Chikitsa

Burn the Bite site

दंशं त्वलर्कदष्टस्य दग्ध्मुष्णेन सर्पिषा ।
प्रदिह्यादगदैस्तैस्तैः पुराणं च घृतं पिबेत् ॥

(A.H.U. 38/35)

The site of bite by the rabid dog should be burnt by hot ghee and covered with warm paste of agada, old ghee should be given for drinking.

Virechana

अर्कक्षीरयुतं चास्य योज्यमाशु विरेचनम् ।

(A.H.U. 38/36)

He should be given a purgative therapy quickly, mixing the milky sap of arka with purgative drug.

अङ्कोल्लोत्तरमूलाम्बु त्रिपलं सहविःपलम् ॥
पिबेत्सधत्तूरफलां श्वेतां वापि पुनर्नवाम् ।

(A.H.U. 38/36)

Juice of root of Ankola spreading northwards -3 palam; 1 palam ghee, Juice of fruits of swetha dhatura, or punarnava with water should be consumed.

Palala prayoga/Arkakshira prayoga

ऐकध्यं पललं तैलं रूपिकायाः पयो गुडः ॥
भिनत्ति विषमालर्कं घनवृन्दमिवानिलः ।

(A.H.U. 38/37)

Palala (dry meat) or powder of fried, Sesame, Taila, milky sap of Rupika, and Guda—all mixed together and consumed destroy poison of rabid dog just like the wind breaks the clouds.

Bath

समन्त्रं सौषधीरलं स्नपनं च प्रयोजयेत् । (A.H.U. 38/38)

Wearing the herbs and precious stones and bathing, fortified with mantra, should be administered.

Steps of Alarka visha Chikitsa:

- ❖ दग्धं with उष्ण सर्पिस्
- ❖ लेपन
- ❖ पुराण घृतपान
- ❖ विरेचन done with अर्क क्षीरं
- ❖ पलल प्रयोगं क्षीरिवृक्षत्वगालेप
- ❖ स्नानं

Sharapunkhadi apupa prayoga

मूलस्य शरपुङ्खुयाः कर्षं धत्तूरकार्थिकम् ।
तण्डुलोदकमादाय पेषयेत्तण्डुलैः सह ॥
उन्मत्तकस्य पत्रैस्तु संवेष्ट्यापूपकं पचेत् ।
खादेदौषधकाले तमलर्कविषदूषितः ।
करोति श्वविकारास्तु तस्मिञ्जीर्यति चौषधे ॥
विकारा शिशिरे याप्या गृहे वारिविवर्जिते ।
तत शान्तविकारास्तु स्नात्वा चैवापरेहनि ।
शालिषष्टिकयोर्भक्तं क्षीरेणोष्णेन भोजयेत् ।
दिनत्रये पञ्चमे वा विधिरेषो अर्धमात्रया ॥
कर्तव्यो भिषजाऽवश्यमलर्कविषनाशनः ।
कुप्येत् स्वयं विषं यस्य न स जीवति मानवः ॥
तस्मात् प्रकोपयेदाशु स्वयं यावत् प्रकुप्यति ।

(A.H.U. 38/53-58)

Sharapumkha root-1 karsha- Dhatura -1/2 karsha, should be pounded with rice water along with rice. This should be wrapped with dhatura leaves and cooked into Apupa, which should be taken by the person, afflicted with poison, or rabid animal at proper time of taking drugs.

This recipe after digestion produces activities of the dog, which should be managed in a cool chamber free from water. When the complication is pacified, the patient should be bathed the next day, and served with food consisting of boiled rice of *sali* and *shashtika* along with hot milk. This procedure should be repeated necessarily on the fifth day in half dose in order to destroy the poison of

rabid animal. The patient does not survive if the poison does not aggravate on its own, hence it should be excited immediately so that it may get aggravated on its own.

Rabies

Rabies is a viral infection caused by Lyssa virus that is characterized by encephalitis in humans and other mammals. It is referred as hydrophobia (fear of water) due to the symptoms of panic when presented with liquids to drink.

Early symptoms include fever and abnormal sensations at the site of exposure. This is followed by symptoms like nausea, vomiting, violent movement, uncontrolled excitement, and fear of water, an inability to move parts of the body, confusion and loss of consciousness. Once the symptoms start to appear, the result is virtually always death regardless of treatment.

The time period between contracting the disease and the start of symptom is usually 1-3 months but can vary from less than 1 week to more than 1 year. The time depends on the distance the virus must travel along peripheral nerves to reach the central nervous system.

Management and vaccination of PEP (post exposure prophylaxis)

1. Wounds must be immediately washed/flushed for 15 minutes and disinfected.
2. Rabies PEP should be instituted immediately. PEP consists of a course of potent, effective rabies vaccine that meets WHO recommendations and administration of rabies immunoglobulin.
3. PEP must be applied using vaccine regimens and administration routes that have been proved to be safe and effective.

4. No contra indications for PEP, pregnancy and infancy are not contra indicated in this.
5. PEP should be administered even if the suspect animal is not available for testing or observation. However, vaccine and immunoglobulin administration may be discontinued if the animal involved is vaccinated, and following observation for 10 days remains healthy or is humanly killed and declared negative for rabies by a WHO prescribed laboratory test.

Wound Treatment

- ❖ Should be immediate
- ❖ Is essential even long after exposure

Consist of:

- ❖ Immediate washing and flushing wound for 15 minutes with soap, water, or water alone.
- ❖ Disinfection with detergent (ethanol; 700ml; iodine (tincture/aqueous solution).
- ❖ Bleeding at any wound site indicates potentially severe exposure and must be infiltrated with either human or equine rabies immunoglobulin.
- ❖ Other treatments: Administer antibiotics and tetanus toxoid prophylaxis.

(See table next page)

Administration of Rabies Immunoglobulin (RIG)

- ❖ Administration of rabies immunoglobulin to wounds is classified as category 3 exposure is very important in case of management of wounds.
- ❖ RIG is administrated into the depth of the wound and around the wound as much as anatomically feasible.
- ❖ Remaining RIG should be injected at an intramuscular site distant from that of vaccine inoculation (e.g: into anterior thigh).

Rabies post-exposure prophylaxis modalities

Categories of contact with suspect rabies animal	Post-exposure prophylaxis measures
Category I • Touching of feeding animals • Licks on intact skin	None
Category II • Nibbling of uncovered skin • Minor scratches or abrasions without bleeding	1. Immediate vaccination and 2. Local treatment of wound
Category III • Single or multiple transdermal bites or scratches • Licks on broken skin • Contamination of mucous membrane with saliva from licks • Contacts with bats	1. Immediate vaccination 2. Administration of rabies immunoglobulin 3. Local treatment of the wound

- ❖ If the RIG is unavailable on the first visit, its administration can be delayed by a maximum of 7 days from the date of first vaccine dose.

Intramuscular regimens for rabies Post-Exposure Prophylaxis.

There are 3 intramuscular schedules for category 2 & 3 exposures:

- ❖ The 5 dose regimen
- ❖ The 2-1-1 regimen
- ❖ The 4 dose regimen with RIG in both categories 2&3.

The vaccines should be injected into the deltoid muscle for adults and children aged 2 years and more. The anterolateral thigh is recommended for young children.

Vaccines should not be injected into the gluteal region:

- ❖ **The 5-dose intramuscular regimen (1-1-1-1-1)**
 - One dose of the vaccine should be administered on the days 0, 3, 7, 14 & 28.
 - Given in the deltoid region or for young children, into the anterolateral area of the thigh muscle.
- ❖ **The 2-1-1 regimen (2-0-1-0-1)**

- The doses are given on 0 (day-0) in the deltoid muscle, right and left arm (day-0).
- An additional one dose is administered in the deltoid on the 7 & day 21.

Intradermal (ID) regimen for rabies Post-Exposure – prophylaxis

- ❖ The intradermal regimen requires a reduced volume of vaccine to be utilised than any of the intramuscular regimen therefore reducing the vaccine cost by 60-80%.
- ❖ This method is appropriate where vaccine or money are very less in rural areas.
- ❖ The volume per intradermal (ID) sites is 0.01ml.

For category 2 & 3

The 2-site intradermal method: (2-2-2-0-2)

One dose of vaccine, of 0.1mL is given intradermally at two different lymphatic drainage sites, usually administered in the deltoid muscle on the left and right upper arm and subscapular area, given on days 0, 3, 7, & 28.

Pre exposure rabies prophylaxis: It can be done in anyone who is at continual, frequent or increased risk for exposure to the rabies virus. Intramuscular- One intramuscular dose is given in (0-7-21-28 day) Site of injection: Deltoid for adults,

anterolateral thigh for children less than 2 years. Intradermal injection of 0.1mL is given on (0-7-21-28).

Booster dose of rabies vaccination: Persons working with live rabies virus in diagnostic lab, research lab and vaccine production centre at permanent risk of exposure to rabies should have:

- ❖ One serum sample taken every 6 months
- ❖ A booster dose when the titre falls below 0.5IU/ml.

11.6 Kita Visha

Origin of Kita

सर्पाणामेव विण्मूत्रशुकाण्डशक्वकोथजाः ।

दोषैर्व्यस्तैः समस्तैश्च युक्ताः कीटाश्चतुर्विधाः ॥

(A.H.U. 37/1)

Kita formed from putrefied Urine, Faeces, Semen, Egg and Cadaver of Snakes only and are of 4 types.

Kita -types

Types-1

1. Vataja kita
2. Pittaja kita
3. Kaphaja kita
4. Sannipatika kita

Types-2

1. Vayavya kita
2. Agneya kita
3. Soumya kita
4. Sannipatika kita

Types-3

1. Manda visha kita
2. Thikshna visha kita

Types -4

1. Dushivisha kita
2. Pranahara kita

Kita visha lakshana according to Dosha

दृष्टस्य कीटैर्वायव्यैर्दशस्तोदरुजोल्बणः ।

आग्नेयैरल्पसंस्त्रावो दाहरागविसर्पवान् ॥

पक्वपीलूफलप्रख्यः खर्जूरसदृशाऽथवा ।

कफाधिकैर्मन्दरुजः पक्वोदुम्बरसन्निभः ॥

स्त्रावाढ्यः सर्वलिङ्गस्तु विवर्ज्यः सान्निपातिकैः ॥

(A.H.U. 37/2-4)

(See table bottom)

According to Acharya Sushruta

Number of Kita

- ❖ Vataja kita-18 in number
- ❖ Pittaja kita-24 in number
- ❖ Kaphaja kita-13 in number
- ❖ Sannipataja kita-12 in number

Classification of Kita - According to severity

- ❖ Tikshna visha kita
- ❖ Manda visha kita

Tikshna visha kita lakshanas

ज्वराङ्गमर्दरोमाञ्चवेदनाभिः समन्वितः ।

छर्द्यतीसारतृष्णाश्च दाहो मूर्च्छा विजृम्भिका ॥

वेपथुश्वासहिक्काश्च दाहः शीतं च दारुणम् ।

पिडकोपचयः शोफो ग्रन्थयो मण्डलानि च ॥

दद्रवः कर्णिकाश्चैव विसर्पाः किटिभानि च ।

तैर्भवन्तीह दष्टानां यथास्वं चाप्युपदवाः ॥

(Su. Ka. 8/19-21)

Fever, body ache, horripilations, pain, vomiting, diarrhoea, thirst, burning sensations, fainting, excessive yawning,

Vata kita	Pitta kita	Kaphaja kita	Sannipatika kita
Damsa toda and ruja (painful)	Alpa srava-less exudation Daha-burning pain Raga-redness Visarpavaan-eruptions in the skin Looks like -mature pilu phala or like kharjura	Mandaruja-less painful Looks like- mature udumbara sannibha	Which possess all the lakshanas Incurable

trembling, dyspnoea, hiccough, severe heat and cold, eruptions of boils, inflammatory swelling, enlarged glands, round patches, ring worms, auricle shaped growth, erysipelas bacterial skin infection and kitibha Kushtha, that occur complications are after bite according to respective dosha. The other specific signs should also be distinguished quickly after examining signs of aggravation of dushivisha, and intake of poison. These are the symptoms of those having severe poisoning.

प्रसेकारोचकच्छर्दिशिरोगौरवशीतकाः ॥

पिडकाकोठकण्डूनां जन्म दोषविभागतः ।

(Su. Ka. 8/23)

Excessive salivation, anorexia, vomiting, heaviness in head, slight sensation of cold boils allergic patches and itching happen according to respective dosha.

Kita visha Chikitsa

कीटानां त्रिप्रकाराणां त्रैविध्येन क्रिया हिता ।

स्वेदालेपनसेकाश्च कोष्णान् प्रायोऽवचारयेत् ॥

अन्यत्र मूर्च्छितादंशपाकतः कोथतोऽथवा ।

(A.H.U. 37/22)

For vata, pitta, kaphaja pradhana types of insects, three kinds of treatment are suitable. Swedana (fomentation), lepana (application), seka (pouring medicated water) should be done warm, except when the person has lost consciousness and when there is ulceration by the bite or putrefaction by the bite.

Nrikesadi Dhupanam

नृकेशाः सर्षपाः पीता गुडो जीर्णश्च धूपनम् ॥

विषदंशस्य सर्वस्य काश्यपः परमब्रवीत् ।

(A.H.U. 37/23-24)

Nrikesa (human hairs), pitasarshapa and jirnaguda used for fumigation of the bite is best for the person bitten by all kinds of poisonous animals, according to Kashyapa.

Importants of Shodhanakriya

विषघ्नं च विधिं सर्वं कुर्यात् संशोधनानि च ।

(A.H.U. 37/24)

All anti-poisonous therapies should be administered along with purifactory therapies.

Tanduliyakadi pana

साधयेत्सर्पवद्दृष्टान् विषोऽग्रैः कीटवृश्चिकैः ।

तन्दुलीयकतुल्यांशं त्रिवृता सर्पिषा पिबेत् ॥

याति कीटविषैः कम्पं न कैलास इवानिलैः ।

(A.H.U. 37/25)

Equal quantities of tanduliyaka and trivrit should be consumed mixed with ghee. The person who consumed this does not get shaken by the poison of insects just as the mountain Kailasa by the storm/wind.

Lepa

क्षीरिवृक्षत्वगालेपः शुद्धे कीटविषापहः ।

(A.H.U. 37/26)

Application of the paste of mukta (pearl) is best to cure swelling, pricking pain, burning and fever.

Specific Formulations:

Dashanga Agada

वचा हिङ्गुः विडङ्गानि सैन्धवं गजपिप्पली ॥

पाठा प्रतिविषा व्योषं काश्यपेन विनिर्मितम् ।

दशाङ्गमगदं पीत्वा सर्वकीटविषं जयेत् ।

(A.H.U. 37/28-29)

Vacha, hingu, vidanga, saindhava, gajapip-pali, pata, prativisha and vyosha are made into paste and rolled into pills; this dasanga agada formulated by kasyapa cures the poison of all kinds of insects.

11.7 Vector-Borne Diseases

❖ Vector-borne diseases account for more than 17% of all infectious diseases, causing more than 70,000 deaths annually. They

can be used by either parasites, bacteria, or viruses.

❖ Vectors are living organisms that can transmit infectious pathogen between humans or from animals to humans. Many of these vectors are blood-sucking insects, which ingest disease-producing microorganisms during a blood meal from an infested host (human or animal) and later transmit into a new host, after the pathogen has replicated.

❖ Vector-borne diseases are human illness caused by parasites, virus and bacteria that are transmitted by vectors. Every year there are more than 700,000 deaths from diseases

such as malaria, dengue, schistosomiasis, human African trypanosomiasis, leishmaniasis, chagas disease, yellow fever, Japanese encephalitis and onchocerciasis.

❖ This is most common in tropical countries, and subtropical areas as they commonly affect the poor population.

List of Vector-borne diseases, according to their vector as per WHO guideline

❖ The following table is a non-exhaustive list of vector-borne disease, ordered according to the vector by which it is transmitted. The list also illustrates the type of pathogen that causes the disease in humans.

Vector		Disease caused	Type of pathogen
Mosquito	<i>Aedes</i>	Chikungunya	Virus
		Dengue	Virus
		Lymphatic filariasis	Parasite
		Rift Valley fever	Virus
		Yellow Fever	Virus
		Zika	Virus
	<i>Anopheles</i>	Lymphatic filariasis	Parasite
		Malaria	Parasite
	<i>Culex</i>	Japanese encephalitis	Virus
Lymphatic filariasis		Parasite	
West Nile fever		Virus	
Aquatic snails		Schistosomiasis (bilharziasis)	Parasite
Blackflies		Onchocerciasis (river blindness)	Parasite
Fleas		Plague (transmitted from rats to humans)	Bacteria
		Tungiasis	Ectoparasite
Lice		Typhus	Bacteria
		Louse-borne relapsing fever	Bacteria
Sandflies		Leishmaniasis	Parasite
		Sandfly fever (phlebotomus fever)	Virus
Ticks		Crimean-Congo haemorrhagic fever	Virus
		Lyme disease	Bacteria
		Relapsing fever (borreliosis)	Bacteria
		Rickettsial diseases (e.g.: spotted fever and Q fever)	Bacteria
		Tick-borne encephalitis	Virus
		Tularaemia	Bacteria
Triatome bugs		Chagas disease (American trypanosomiasis)	Parasite
Tsetse flies		Sleeping sickness (African trypanosomiasis)	Parasite

Many of vector-borne diseases are preventable through protective measures and community mobilisation.

Summary

Jangama visha or animal poisoning is caused by organisms like sarpa (snakes), mushaka (ats), luta (spider), alarka (rabid dog), vrischika (scorpion) and kita visha (insects bite).

Jangama visha adhishtanas

- | | |
|-------------|--------------|
| • Drishti | • Artava |
| • Niswasa | • Mukha |
| • Damshttra | • Suka tunda |
| • Nakha | • Ara |
| • Muthra | • Visardita |
| • Purisha | • Asthi |
| • Shukra | • Pitta |
| • Lala | • Sava |

Lakshanas of Jangama visha

Nidra (sleepy), tandra (tiredness), klama (exhaustion), daha (burning sensation), paka (inflammation), loma harsha (horripilation), sopho (odema), atisra (diarrhea).

Classifications of Snakes

Mainly of 2 types

1. Divya
2. Bhauma sarpa

Bhauma sarpa is again divided mainly into-

1. Darvikara (Cobra)
2. Mandala (Viper)
3. Rajila (Krait)

(See the table bottom)

Types of Bite

❖ A.H. says 5 types

- | | |
|-------------------|------------|
| • Tundahata | • Vyalupta |
| • Vyalida | • Dashtaka |
| • Dashtanipiditha | |

❖ Sushruta says 3 types

- Sarpida
- Radita
- Nirvisha

(See the table next page)

Darvikara	Mandali	Rajila	Vaikaranja
• 26 in number • Hooded • Fast moving • Marks of plough, wheel, umbrella, swastika sign on hood • Moves more in the day • Poisonous effects more in the young age • Vata predominant	• 22 in number • Hood absent • Moves very slowly • Skin is variegated with different types of circular marks • Lustrous • Active during night except in the last yama of night • Visha is more in Madhya age (A:H) • Vitiates pitta dosha	• 10 in number • No hood • Stripes with different colour present in the body • Unctuous • Very active in the last yama (3 hour) of night • Poisonous effect is more in the older snakes • Vitiates kapha	• 10 in number (vaikaranja+vaikara njobbhava) • Hybrid variety of snake • Possess combined features • Vitiates 2 doshas depends on the combination

Visha vega Lakshanas and Chikitsa (Su. K. 5th)

Vega	Darvikara	Mandali	Rajila
1st vega	Vitiattion of blood Blackish discolouration Dark complexion of skin Feeling of insects crawling on the body Rx Raktamokshana by siravyadha	Rakta dushti Severe burning sensation Yellowish discolouration of the body Rx Raktamokshana	Rakta dushti Pale yellow colour and goose like appearance Whitish skin Rx Raktamokshana by alabu
2nd vega	Mamsa dhatu dushti Swelling Rx Madhu and ghrita agadapana	Extreme yellowish colouration of the body Severe burning sensation Swelling at the site Rx Madhu and ghrita agadapana & yavagu seva	Extreme pale complexion Swelling on head Rx Vamana and agadapana with madhu and ghrita
3rd vega	Medo dhatu dushti Heaviness of head Loss of vision Moistness at the bite site Rx Visha samana nasya and anjana	Numbness of eyes Thirst Swelling slimy exudation from the bite site Rx Virechana & yavagupana	Haziness of eyes Deposit of filthy matter on teeth Perspiration Secretion from nose and eyes Rx Visha samana nasya and anjana
4th vega	Vitiate kapha dosha Excessive salivation Joint pain, lethargy and vomiting Rx Vamana & yavagu pana	Severe fever as poison enters koshta Rx Vamana & yavagu pana	Poison enters koshta Lock jaw Heaviness of head Rx Vamana & yavagu pana
5th vega	Vitiate pranavaayu and Agni Joint pain, hiccups and burning pain Rx Seethalopachara Virechana yavagu pana	Severe burning sensation all over the body Rx Seethalopachara Virechana yavagu pana	Vitiates vata dosha Loss of speech Seethe jwara Rx Teekshna anjana
6th vega	Vitiates grahani Severe chest pain Heaviness Delirium Diarrhoea Rx Seethalopachara Virechana yavagu pana	Vitiates grahani, pain and heaviness in the chest, Delirium diarrhoea Rx Kakolyadi madhura gana varga	Vitiates grahani Pain and heaviness in the chest Delirium and diarrhoea Rx Nasya

Vega	Darvikara	Mandali	Rajila
7th vega	Aggravates vyana vata, lump like kapha, secetions from the mouth, breaking pain in the waist and back, impaired functions of mind and the body,excessive salivation, perspiration, suppression of breath	Aggravates vyana vata, lump like kapha, secetions from the mouth, breaking pain in the waist and back, impaired functions of mind and the body,excessive salivation, perspiration, suppression of breath	Aggravates vyana vata, lump like kapha, secetions from the mouth, breaking pain in the waist and back, impaired functions of mind and the body,excessive salivation, perspiration, suppression of breath
Rx	Rx	Rx	Rx
Tikshna anjana	Agadapana	Avapeeda nasya	Avapida nasya
Nasya			
Kakapada chikitsa			

Luta visha

Luta is more powerful than any other kita and are said to 16 kinds.

Site develop dwelling like dadru mandala which is white, blackish, red, yellow or blue in colour, soft elevated black or blue in the center and sieve like edges, swelling spreads side-wards, torments the body greatly, fever, quick suppuration, exudation, putrefaction and tissue loss all develop, ulcers forms on that part where it comes in contact with the pus.

Adhishthana of luta visha

- Swasa
- Damshttra
- Shakrit
- Mutra
- Shukra
- Lala
- Nakha
- Artava

Features of Spide poisons day wise

(See the table bottom)

Treatment

Dasa vidha upakrama

- Nasya
- Anjana
- Abhyanga
- Pana
- Dhuma
- Avapida
- Gandusha
- Vamana
- Vireka

Commonly used yogas in lutha Chikitsa
(Reference: Prayoga samuchayam Malayalam Traditional Visha Chikitsa book)

Neelidaladi ghruta

Ingredients: Nilini, tulasi, nirgundi (pathra swarasa): 1 litre

Ghruta: 1 litre

1 st day	2 nd day	3 rd day	4 th day	5 th day	6 th day	7 th day
• Needle prick marking • No discolouration • Itching	• Raised edges at the site of bite • Surrounded by eruptions all around • Skin colour change • Depressed in the centre • itching	• fever • horripilation • red circular patches • saucer shaped wound • severe agonizing pain • discharge from hair follicles	• swelling • temperature • dyspnea • giddiness	• Dosha predominant symptoms	• Mama affected	• Death

Kalka dravya: Lasuna, vyosha, ashwagandha, chandana, Yashtimadhu, tagara, kushta, saribamula, eshwarimula: 10 gms each.

The whole ingredients were processed and made according to the ghritha kalpana. The same drugs are processed with coconut oil for external application in skin diseases which are very effective.

Nili tulasyadi kashaya

Equal quantities of Nili mula, Krishna tulasi mula, nirgundi mula, eshwari mula, sariva mula, lasuna, sunthi, maricha, pippali, ashwagandha, chandana, kushta, tagara, yashtimadhu are made into kashaya and are given along with bilwadi gutika. This preparation is not only helpful for spider poison but also for other types of poisons.

Vrishchika Visha

The scorpions are born from the putrefied, dung of cow etc., cadaver of animals killed by poisoned arrow and cadaver of snakes and are of 3 kinds—

1. Manda visha
2. Madhyama visha
3. Maha visha

Samanya lakshana of Vrishchika

Bitten by scorpion the person develops swelling of the tongue, rigidity of the body, fever, black coloured blood comes out from all the orifices, there is loss of sensory perceptions, sweating, fainting, dryness of the mouth, unsound mind, suffer from discomfort, wasting of the muscles (emaciation) and even death.

Ushtradhumaka visha lakshana

- ❖ Intense pain
- ❖ Stiffness of penis
- ❖ Horripilation
- ❖ Feeling of body being sprinkled with cold water

Treatment Principles

1. Sechana with chakra taila or vidayadi gana siddhga taila.
2. Swedana
3. Panam
4. Dhupanam
5. Pratisarana
6. Lepa

Mushaka visha

Vishadhishtaana – shukra

Asadhya lakshana

Swelling of urinary bladder, discoloration of lips, body covered with nodules resembling rats, emits smell of rats etc.

Management

- ❖ Dahana
- ❖ Prachana
- ❖ Pralepana
- ❖ Amla dravya lakshalana
- ❖ Siramoksha
- ❖ Chardana
- ❖ Virechana
- ❖ Sirovirechana
- ❖ Samana kashaya pana

Alarka visha

Lakshana of rabid animal

The doshas among which kapha is predominant get aggravated, invade the sanjavaha srotas and produce serious disorders of the mind and tissues in the body of the dog. It runs all over the place with saliva dribbling, blind and deaf with its tail, lower jaw and shoulders dropping troubled in the head and with its face down.

Asadhya lakshana

The person imitates the animal in its action and cry which has bitten him, sees them accidentally in the mirror water etc. and dies.

That person who becomes afraid of water by its sound, sight and touch even though not bitten is also designated as affected by Jalasantrasa or hydrophobia and should be refused treatment or (Asadhya).

Management

1. Dahana with ushna sarpis
2. Agada applications
3. Purana ghrita pana
4. Virechana using arka kshira

Kita visha

Kita formed from purified Urine, Faeces, Semen, Egg and Cadaver of Snakes only and are of 4 types.

1. Vataja kita
2. Pittaja kita
3. Kaphaja kita
4. Sannipataja kita

Other Classification

1. Tiksha visha kita
2. Manda visha kita

Tikshna visha kita lakshanas

Fever, body ache, horripilations, pain, vomiting, diarrhoea, thirst, burning sensations, fainting, excessive yawning, trembling, dyspnoea, hiccough, severe heat and cold, eruptions of boils, inflammatory

swelling, enlarged glands, round patches, ring worms, auricle shaped growth, erysipelas and kitibha, these complications arises after bite according to Respective Dosha. The other specific signs should also be distinguished quickly after examining signs of aggravation of dooshivisha, and intake of poison. This is the feature of those causing severe poisoning.

Manda visha kita lakshana

Appearance of excessive salivation, anorexia, vomiting, heaviness in head, and slight sensation of cold boils allergic patches, itching according to respective dosha.

Chikitsa of kita visha

For vata, pitta, kaphaja pradhana types of insects three kinds of treatment are suitable. Swedana (fomentation), lepana (application), seka (pouring medicated water) should be done warm, except when the person has lost consciousness, when there is ulceration by the bite or putrefaction by the bite.

Dashanga agada

Vacha, hingu, vidanga, saindhava, gajapipali, pata, prativisha, vyosha are made into nice paste and rolled into pills; this dashanga agada formulated by Kashyapa cures the poison of all kinds of insects.

Important Questions MCQ

1. Asadhya sarpa damsa is

- a. Tundahata
- b. Vyalida
- c. Vyalupta
- d. Dasta nipidita

2. The bite causes tearing of mamsa, always flow of blood occurs

- a. Tundahata
- b. Vyalida
- c. Vyalupta
- d. Dastaka

3. Arishta bandha should be done at a distance of –

- a. 2 angula c. 2 inches
b. 4 angula d. 4 cm

4. Upadaana chikitsa or kakapada chikitsa is done at – vega

- a. 6th c. 8th
b. 7th d. 1st

5. The damsha sthana of pittaja kita is looks like

- a. Pakva pilu phala
b. Kharjura sadrsha
c. Jambu phala
d. Both a&b

6. The visha which is very tikshna and kills like a burning fire

- a. Kita visha
b. Mushaka visha
c. Vrishchika visha
d. Alarka visha

7. Paramam vrishchikagada is

- a. Dashanga gulika
b. Hingavi gulika

c. Shirisha bijadi agada

d. Patmakadi agada

8. The ghoratama visha or durvijneya visha is

- a. Kita visha
b. Mushaka visha
c. Vrishchika visha
d. Luta visha

9. The visha which vitiates like dushi visha (or bhuyo bhuyshcha)

- a. Kita visha
b. Mushaka visha
c. Vrishchika visha
d. Luta visha

10. Jalasanthrasa is seen in

- a. Kita visha
b. Mushaka visha
c. Vrishchika visha
d. Alarka visha

Answer key

1. d	2. d	3. b	4. b	5. d
6. c	7. b	8. d	9. b	10. d

Learning Objectives

- Describe the three Sarpas and its identification features, vega lakshanas, treatment, fatal dose, fatal period, signs and symptoms of cobra, viper and krait.
- Differentiate between venomous and non-venomous snakes, describe the snake bite management principles as per WHO.
- Describe the classification, diagnosis, samanya lakshanas and chikitsa of Luta visha with its contemporary aspects.
- Describe the classification, diagnosis, samanya lakshanas and chikitsa of Vrishchika visha with its contemporary aspects.
- Describe the classification, diagnosis, samanya lakshanas and chikitsa of mushaka visha with its contemporary aspects.
- Describe the classification, diagnosis, samanya lakshanas and chikitsa of alarka visha with its contemporary aspects.
- Describe the application of vish chikitsa in vector-borne diseases like malaria, dengue and chikungunya.

Important SAQ

1. Write briefly on Damsa bhedas of sarpa visha.
2. Explain kita visha Dashanga agada.
3. What are mushaka visha samanya lakshanas.
4. Write about dasa vidha upakramas of luta.
5. Write about classification of vrishchika.
6. What is Anti snake venom?
7. What are vector-borne diseases?
8. What is Jalasanthrasa?
9. Write on treatment in kita visha.
10. Differentiate between poisonous and non-poisonous snakes.

Important LAQ

1. Explain sarpa visha vegas and their treatment.
2. Explain the yogas in sarpa visha.
3. Explain luta visha lakshana and treatment with contemporary significance.
4. Explain alarka visha and the treatment along with rabies vaccination schedule.
5. Classification of vrishchika, their clinical features, and the treatments.

• • •

Kritrima Visha

12.1 Inorganic Acids—Sulphuric acid, Hydrochloric acid, Nitric acid

Corrosives

Corrosives are those substances which corrode and destroy tissues through direct chemical action, which is both local and systemic.

Acids and Alkalis: They cause Corrosive Poisoning.

Action of Corrosive poisons

- ❖ Strong acids + alkalis – Corrosive action
- ❖ Dilute acids + alkalis – Irritants
- ❖ Strong acids + any body parts – Coagulation necrosis.

Caustics

Acids are hydrogen containing substances which on dissociation in water produce hydronium ions. (See the table below)

Pathophysiology of Corrosives

A. Acute inflammatory phase: First 4-7 days, main characters vascular thrombosis, cellular necrosis, with destruction of

epithelial tissues, sub mucosa and muscularis, ulcer forms.

B. Latent granulation: Begin with middle of first week up to end of second week, collagen starts to replace the granulation tissue, perforation happens in this stage where tissue is very weak.

C. Chronic cicatrization phase: (2-4 weeks after injury), occurs dense fibrous scar tissues around sub mucosa and muscularis.

(See the table next page)

Action of Inorganic acids in the Body

Strong acids + any part of body

Extraction of water



Liberation of heat



Coagulation of Precipitation of cellular proteins



Conversion of Hb (haemoglobin) to haemalin



Corrosion and destruction of tissues

Classification of Corrosives

Strong inorganic acids	sulphuric acid	nitric acid	hydrochloric acid
Strong organic acids	oxalic acid	carbolic acid	formic acid
Alkalis	potassium hydroxide	sodium hydroxide	

Differences between Acids and Alkalies

Injury/characters	Acids	Alkalies
Causes significant injury at pH	<3	>11
Severity	Less severe	More severe
Type of necrosis	Coagulative	Liquefactive
Formation of eschar/coagulum	Yes	No
Depth of injury	Limited by coagulum formation	Deep
Risk of perforation	Lower	Higher
Location of injury	Predominantly oesophagus due to slow eosophageal clearance	Predominantly due to rapid eosophageal clearance

Sulphuric Acid (H_2SO_4)

Sulphuric acid: (oil of vitriol) - is a non-fuming acid

Fatal dose: 5-10 mL, FP: 12-24hrs

Signs and Symptoms:

1. **GIT:** Lips are swollen, excoriated with brown or black colour, teeth chalky white in colour. Tongue gets swollen, sodden and blackish. Pharyngeal pain on swallowing is an important symptom. Vomitus is brown, black, or mucoid and may contain shreds of charred walls of stomach. Feeling of intense thirst occurs if the person tries to drink causing vomiting. Abdomen becomes distended and tender.
2. Sunken eyes with dilated pupil
3. Asphyxia occurs due to oedema of glottis
4. Burns are painless
5. Mind - Remains clear till death

Cause of Death

Spasm/oedema of glottis or due to circulatory collapse. Collapse due to stomach perforation, toxemia, delayed death due to secondary infections.

Complications: Upper airway obstructions, injury, haemorrhage, sepsis, strictures, stenosis

Autopsy findings:

1. Stomach mucosa is more sensitive to effects of acids. Mucus membrane is edematous, inflamed, blackened, papery feel. Stomach is converted to soft, baggy black mass that readily disintegrates on touching. Necrosed area colour changes from greyish white to brown or black or leathery.
2. **Perforation:** Due to perforation of oesophagus/stomach, the viscera is blackened, corroded with acids indicating chemical peritonitis. Peritoneal cavity is filled with black acidic liquid containing mostly altered blood from escape of acidic stomach contents into peritoneal cavity following perforation of stomach
3. Pyloric injury is common- Initial exposure of the pylorus to acid causes severe spasm, which promotes injury at the site.



Fig: Bloating Paper appearance in stomach mucosa

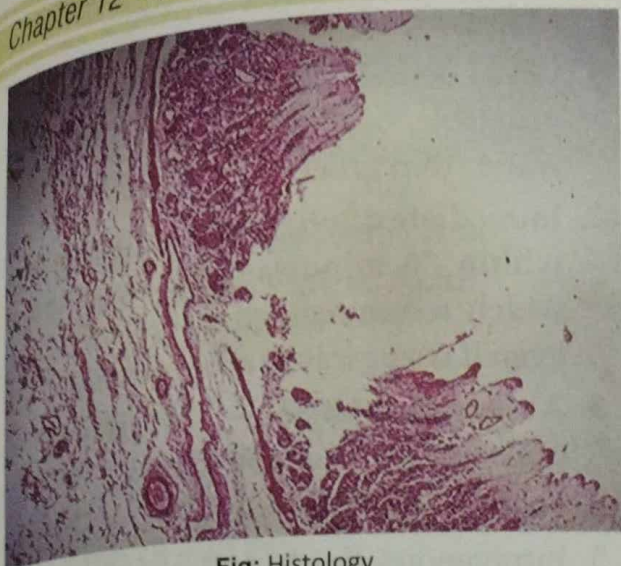


Fig: Histology

Vitriolage

Vitriol (strong sulphuric acid) is thrown on to the body of a person with the intention of injuring or disfiguring him out of a jealousy or revenge. Commonly it is known as acid attack. Nowadays any type of corrosive substance or irritant juice of a plant is thrown over the face, body of victim with the intention of injuring him or her for the purpose of disfiguring him/her out of revenge or jealousy.

Duty of a doctor in case of vitriolage:

There are two types of duties –

1. Medical duties
2. Legal duties

Medical duty: Remove the contaminated clothes and jewellery.

Skin burns: Immediately wash away the corrosive with fresh and cool running water for as long as possible, apply magnesium oxide and carbonate paste, cover the raw surface with tannic acid jelly and soframycin.

Eyes: Wash eyes with water and then irrigate with 1% of NaHCO_3 in water. Then put castor oil or olive oil in eyes.

Legal duties: Vitriolage is a medicolegal case and police should be informed. The doctor must collect and preserve the following

evidences from the body of victim for chemical analysis and then sent to FSL and (a) clothes: (b) plain water swabs.

Vitriolage may lead to grievous hurt-S.IPC 320

1. Permanent privation of sight of either eye- when permanent loss of vision occurs.
2. Destruction or permanent impairment of powers of any member of joint, when extensive contractures restrict the movements of head or neck or other joint permanently.

Punishments

Vitriolage is a very common crime in India. Section 326 A and 326 B of IPC deals with acid attack.

S.IPC 326A: Whoever voluntarily causes grievous hurt to any person by the use of acids will be punished with 10 years of imprisonment and fine.

S.IPC 326B: Whoever throws or attempts to throw acid on any person will be punished with 5-7 years of punishments and fine.

In case of vitriolage (and rape), the state should give compensation to the victim for rehabilitation.

Nitric Acid (HNO_3)

It is a fuming acid and causes yellowish discolouration of tissues, crown of the teeth and clothing. Colour of urine becomes brown.

Xanthoproteic Reaction

If concentrated nitric acid is applied on the skin or mucosa, the skin or mucosal membrane turns yellow. The concentrated nitric acid reacts with organic matter and creates xanthoproteic acid which is yellow and so imparts deep yellow colour to the affected tissues.

Signs and symptoms are similar to sulphuric acid, inhalation of fumes causes irritation

of eyes with lacrymation, sneezing and photophobia. Death may occur immediately from suffocation due to glottis oedema and bronchopneumonia.

FD-10-15 mL FP- 12-24 hrs



Fig: Xanthoproteic reaction Yellow discolouration

Autopsy findings:

- Tissues are stained yellow
- Oesophagus and stomach are not stained yellow but are brown/brownish black due to formation of acid haematin
- Perforation is not common
- Lungs are oedematous and congested

Hydrochloric Acid (HCl)

Hydrochloric acid or muriatic acid is a fuming acid.

FD: 15-20 mL **FP:** 18-36hrs

Clinical features: Less corrosive in its action than sulphuric acid, it does not seriously damage the skin, but readily damages the mucus membrane.

Autopsy features: Mucus membrane at first grey or greyish white, but later becomes brown or brown-black due to the formation of acid haematin

Acid Poisoning Management

1. **Give demulcents:** Milk, egg white, vegetable oil, starch solution, barley water/thin gruel.
2. **Immediate dilution with milk or water within 30 minutes, post ingestion** – widely recommended for oral ingestion, even if tissue injury occurs rapidly.
3. **Airway maintenance**– Artificial respiration – if there is any respiratory distress
4. **For Pain relief:** Give morphine/pethidine
5. Intravenous fluids and electrolyte for dehydration
6. For control of infections – Antibiotics
7. **Skin care** – For any skin lesions involving copious saline irrigation.
8. **Eye care** – for any acid injuries – copious irrigation with retraction of eyelids for 20-30 minutes. Antibiotic eye-drops can combat infections.

Avoid

1. Gastric lavage – to prevent gastric perforation (except Organic acids)
2. Administration Carbonates - yield CO_2 – Distention and Perforation
3. **Emesis** – not attempted fear of stomach rupture
4. **Oral feeding** – Until endoscopy confirms the extent of injury
5. Neutralising with weak bases or alkali - (Milk of Magnesia or lime water) – Since exothermic reaction may extent corrosive injury

Comparison between sulphuric acid/nitric acid/hydrochloric acid

Features	H_2SO_4	HNO_3	HCl
Fuming nature	Non fuming	Fuming	Fuming
Perforation of stomach	Most common	Less common	Less common

Features	H ₂ SO ₄	HNO ₃	HCl
FD	5-10ml	10-15ml	15-20ml
FP	12-24 hrs	12-24 hrs	18-36 hrs

12.2 Organic Acids—Oxalic Acid, Carbolic Acid, Formic Acid

Oxalic acid

Synonyms: Salt of sorrel

Physical appearance: Colourless, Whitish, Odorless, Prismatic crystals

Fatal dose: 15 – 30 gm

Clinical Features

Local	Systemic
Whitish or yellowish corrosion discolouration with underlying congestion	Vomiting (Coffee Ground) Hypocalcaemia (Tetany)
Corroded mucosa looks like scalded	Characterised by tonic muscle spasms, cramping, Accoucher's hand (Special condition)
	This is often a positive Trousseau's and Chvostek's sign (twitching of facial muscles in response to tapping over the facial nerve)
	Pupils are usually dilated.

Treatment

- ❖ Stomach wash with calcium gluconate or lactate solution.
- ❖ Calcium gluconate (IV).
- ❖ Dialysis or exchange transfusion for renal failure.
- ❖ Affected skin or eye should be washed copiously with water.

PM Appearance

- ❖ Scalded mucosa of GI tract.
- ❖ Whitish or yellowish discolouration of corroded area.

Forensic Importance

- ❖ Most of the cases are accidental.
- ❖ Accidental poisoning may also result from excessive ingestion of certain vegetables rich in oxalates (Rhubarb, Sorrel, Cabbage).
- ❖ Chronic consumption of the vegetables can lead to renal calculi with consequent renal colic.
- ❖ Occasionally suicidal and homicidal with oxalic acid have been reported.

Carbolic acid/Phenol

Physical appearance

Colourless, needle like crystals, which turns pink on exposure to air.

Fatal dose: 10-30 gm

Clinical Features

Local	Systemic
Skin or mucosal contact – results in mild corrosion with hardening and whitish discolouration	GIT – Burning Pain, Vomiting
White eschar	CNS – Vertigo, Convulsions Coma, Pupils are Constricted.
Burning pain followed by tingling sensation, numbness, anaesthesia	RS – Slow, laboured, breathing, Progressing to respiratory failure
	Blood – Haemolysis, Meth-haemoglobinemia
	Hepato-renal – oliguria with greenish colour on exposure to air because of phenolic metabolites (Hydroquinone and Pyrocatechol) This is Carboluria.

This is called **Carboluria** – presence of carbolic acid in urine. In the body, phenol is partially oxidised to hydroquinone and

pyrocatechol in urine which causes greenish colouration of urine.

Chronic poisoning – Phenol marasmus

This was common in earlier days among medical personnel when phenol was routinely used as a skin disinfectant. It is characterized by anorexia, weight loss, head ache, vertigo, and dark urine. Bluish green pigmentation of skin and sclera.

Exogenous ochronosis: is a cutaneous disorder characterised by blue black pigmentation resulting as a complication of long-term application of skin due to the topical contact with phenol or resorcinol in dark skinned individuals.

❖ Rx

- Decontaminate skin by copious washing.
- Stomach wash can be done preferably with sodium or magnesium sulphate solution.
- Activated charcoal
- Supportive measures

❖ PM appearance

- Distinct odour of phenol around mouth and stomach.
- Gastric mucosa – greyish white, swollen, hardened.
- Urine greenish/brownish

❖ Forensic Importance

- Accidental poisoning is common
- Occupational exposure/Therapeutic misuse also there.

Formic acid

Formic acid is a colourless liquid with pungent penetrating odour. It occurs naturally in the venom of bees and ant stings.

FD: 50-200 gm.

Signs and symptoms: Haemolysis, acute tubular necrosis, renal failure shock and death, drowsiness, coma, pupils dilated.

Medico legal Aspect: Accidental and suicidal poisoning is common in South India (rubber latex related works uses formic acid so the availability of formic acid is more common). Methanol poisoning occurs due to formic acid generated as a metabolite.

12.3 Alkalis (Potassium Hydroxide and Sodium Hydroxide)

Alkali poisoning commonly happens due to sodium & potassium hydroxide, ammonium hydroxide, sodium and potassium carbonate.

Toxicity

- ❖ Most of the alkalis are white powders or colourless solution.
- ❖ Ammonia is a gas with pungent, choking odour.

Usual **fatal dose:** 10-15 gm in most alkalis,

Fatal period: 15-20mL for ammonia.

Mode of Action

- ❖ Locally – Alkalis produces liquefaction necrosis which results in extensive penetrating damage because of the saponification of fats and solubilisation of proteins.
- ❖ Production of ulcers is common and may persist for several weeks.
- ❖ Esophagus is more severely affected than the stomach, which is opposite to acids.

Clinical Features

- ❖ Corrosion of GI mucosa with greyish pseudo membrane formation. As oesophagus is commonly affected resulting in dysphagia, vomiting, drooling and haematemesis.
- ❖ Abdominal pain, diarrhoea, tenesmus.
- ❖ Skin involvement results in greyish, soapy, necrotic area without charring.
- ❖ Eye involvement causes serious ophthalmologic emergency.

Treatment

- ❖ Respiratory distress requires endotracheal intubation or tracheostomy depends on severity.
- ❖ Oxygen should be given in emergency.
- ❖ Diluents such as milk or water may be given as a first aid.
- ❖ Neutralisation with acids are contraindicated since the resultant exothermic reaction can cause perforation.
- ❖ Contra indication: emesis, gastric lavage, catharsis and activated charcoal.
- ❖ Management to maintain fluid and electrolyte balance.
- ❖ Management should be done for the complications.

12.4 Asphyxiants-Carbon Monoxide and Carbon Dioxide

Asphyxiants are the poisons which cause asphyxia, which are categorized into:

(see the table down)

Carbon Monoxide

It is a colourless, odourless, inflammable, non-irritant highly poisonous gas, produced by the partial combustion of fuels. Carbon monoxide poisoning mainly occurs due to exposure of automobile exhaust, sleeping in a less ventilated room.

This poisoning occurs due to the binding of iron containing haemoproteins; examples haemoglobin, myoglobin, cytochrome P450 and cytochrome oxidase. This also acts as a chemical asphyxiant and induces hypoxia. CO binds with haemoglobin and

forms carboxy haemoglobin and reduces the oxygen carrying capacity of blood. The affinity towards carbon monoxide is 200-250 times greater than oxygen. It affects more importantly the organs which readily demands oxygen, especially heart and brain.

Acute carbon monoxide poisoning:

FD: It is usually expressed in terms of plasma concentration of carbon monoxide.

That is COHb level > 60% is lethal

Clinical Features

- ❖ Symptoms are noticeable only after COHb level is more than 10%.
- ❖ Initially affects the organs with high oxygen demand that is heart and brain.

Poisoning may be:

Mild poisoning: (COHb=10-30%)-Headache, nausea, breathlessness, abdominal pain, dizziness, irritability, lethargy and weakness

Moderate poisoning: (COHb=30-40%)-Severe headache, severe breathlessness, dizziness, drowsiness, disorientation, poor concentration, confusion, impaired judgment, tinnitus, dimness in vision, and chest pain

Severe poisoning: (COHb> 40%): Chest pain, myocardial infarction, arrhythmia, tachycardia, hypotension and urinary incontinence. In brain it causes confusion, hallucinations and ataxia, tremors, slurred speech, convulsions and dilated fixed pupil.

Other Signs

- ❖ Cherry (red) pink colour of skin, especially in extremities and regions of hypostasis.

Simple Asphyxiants	Respiratory Irritants	Systemic asphyxiants
These gases displace oxygen from ambient air and reduce partial pressure of available oxygen Example: CO ₂	These gases damage the respiratory tract by destroying integrity of the mucosal barrier. Examples: Ammonia, Chlorine, Formaldehyde, H ₂ S, Methyl-isocyanate	These produce systemic toxicity by specialised mechanisms. Eg: Carbon monoxide, cyanide, Smoke

- ❖ Skin blisters at wrist, interdigital surface of fingers, knees, calves and buttocks.

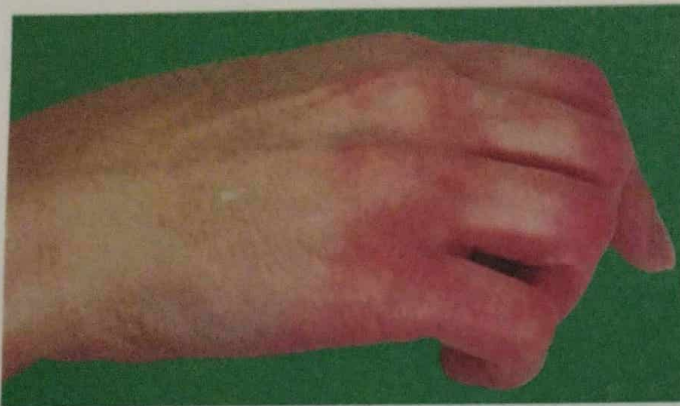


Fig: Cherry red colour of skin

Investigations:

- ❖ Analysing carbon monoxide poisoning is checked by pulse CO-oximeter assessment of carbon monoxide.
- ❖ ECG, troponin and CPK levels.
- ❖ Metabolic acidosis due to accumulation of lactic acid.

Treatment

- ❖ Immediate removal of patient from the source of exposure.
 - Maintain airway breathing circulation (ABC)
 - Hyperbaric oxygen therapy.
 - Anticonvulsants and antibiotics.

Cause of death: Asphyxia

Postmortem Appearance

- ❖ Cherry red colour of the skin, mucus membrane and postmortem hypostasis.
- ❖ Skin blisters at knee, calf, buttocks and so on.
- ❖ Blood is highly fluid in nature
- ❖ Lungs congested oedematous
- ❖ Heart: petechial hemorrhage
- ❖ Brain oedematous and necrosed
- ❖ Retinal haemorrhage

Medico-legal aspect

- ❖ Most cases are accidental
- ❖ Suicidal cases are also reported in western countries.

Carbon Dioxide

It is a heavy, colourless gas, with a faintly sweet odour.

Atmospheric contains 0.33% of CO₂.

Action

Non-toxic but acts as simple asphyxiant prevents tissue from obtaining oxygen.

Signs and Symptoms

- ❖ 5% of CO₂ in air causes laboured breathing and mental confusion.
- ❖ Above 10% ataxia and unconsciousness.
- ❖ 50% - Dyspnoea and discomfort, feeling of tightness of chest.
- ❖ Feeling of fullness of head
- ❖ 60-80% CO₂ – Unconsciousness & Death.

Treatment

Artificial respiration and oxygen should be given freely.

PM signs: There is marked cyanosis, congestion, dilatation of pupils, and petechial haemorrhage.

MLI

CO₂ poisoning – Usually Accidental

12.5 Non-Metallic Poisons – Phosphorous and Cyanide

Phosphorous poisoning

Physical appearance

1. Yellow or white phosphorous—is potent hepato-toxin, protoplasmic poison
2. Red phosphorous is harmless

Fatal dose: 60 mg

Mode of Action

Yellow phosphorous – Protoplasmic poison
is a potent hepato-toxin

Large dose: Shock/Cardio vascular collapse

Locally : Severe irritation to skin.

Clinical Features**1. Fulminant poisoning**

- ❖ Occurs due to ingestion of massive dose is more than 1-2 gm
- ❖ Death occurs usually in 12-24 hours. Signs of hepatic or renal damage are not seen.

2. Acute poisoning**1st stage (up to 3 days)**

- ❖ Severe burning pain
- ❖ Vomiting
- ❖ Diarrhoea, abdominal pain
- ❖ Breath smells like garlic
- ❖ Vomitus/stool may be luminous in the dark.
- ❖ Smoky stool syndrome (faint fumes may emanate from stools).

2nd stage

- ❖ Up to several days after the first stage
- ❖ This is essentially symptoms free

3rd stage

- ❖ This is systemic effect of phosphorous after it has been absorbed.
- ❖ Hepatomegaly - Jaundice, Pruritis, bleeding from gum.
- ❖ At this stage there is Mousy odour to the breath (foetor hepaticus).
- ❖ Renal damage results in oliguria, haematuria, albuminuria, and acute renal failure.

Diagnosis

- ❖ Garlicky odour of breath and vomitus
- ❖ Fuming or luminous vomitus and stools
- ❖ Evidence of hepatic renal failure

Chronic Poisoning

This is usually results from long-term occupational exposure to the fumes of phosphorous peroxide and results in **Phossy Jaw or Glass Jaw**.

Treatment**1. Acute poisoning**

- ❖ Gastric lavage with potassium permanganate (1:5000)
- ❖ Do not administer milk or any oily, fatty foods, since this will enhance the absorption of phosphorous
- ❖ Vit. K (IV drip)
- ❖ IV fluids

2. Chronic poisoning

- ❖ Remove the patient from the source of exposure
- ❖ Dental treatment for follow up

PM appearance

- ❖ Garlicky odour from the vicinity of mouth
- ❖ Jaundice
- ❖ Bleeding points in the skin
- ❖ Luminous gastric contents
- ❖ Congested and inflammation of affected skin and mucosa
- ❖ Enlarged fatty liver
- ❖ Viscera for chemical analysis preserved in saturated saline and rectified spirit.

Forensic importance

- 1. Accidental poisoning:** Accidental ingestion of rat poisoning of cockroach poison.
- 2. Suicidal poisoning** of rat poisoning.
- 3. Homicidal poisoning:** Formerly phosphorous commonly used for committing murder.

Cyanide Poisoning**HCN occurs in 3 states**

- ❖ Gaseous form is called HCN, also known as prussic acid Scheele's acid.

- ❖ Liquid form called HCN is also known as cyanogen.
- ❖ Solid salt of hydrogen cyanide.

At ordinary temperature and pressure, HCN is a gas having penetrating odour resembling that of a bitter almond. HCN (liquid/gas) absorption is more rapid than its salt form.

After absorption, a greater part of cyanide is converted by mitochondrial enzyme into 'thiocyanata' which is excreted through urine.

Action in the Body

It inhibits the enzyme cytochrome oxidase which badly effects cellular oxidation causing anoxia.

FD: HCN (50mg), KCN & NaCN (250 mg)

Fatal period: Death can occur within seconds or minutes based on the concentration of HCN.

Medico-legal Importance

- ❖ The manner of poisoning is accidental when unknowingly eating bitter almond, while handling cyanide in labs and accidental and suicidal cyanide poisoning occurs in jewelers because a mixture of $(KCN + H_2O_2 + H_2O)$ is used in gold stripping process.
- ❖ Suicidal poisoning: Terrorists, immediately engulfing pellets of cyanide salts.
- ❖ Homicidal poisoning is rare
- ❖ Cyanide in dead produces putrefaction in a low rate. It can be detected in exhumed bodies even after 18 months. Embalming can destruct cyanide.

Chronic cyanide poisoning

It occurs in chronic smokers and industrial workers, characterised by (1) **Leber's hereditary optic neuropathy**, (2) **tropical ataxic neuropathys** which occur due to

consumption of improperly processed cassava roots.

Treatments

1. Remove the patient from source of poisoning, protection gloves and mask should be worn by the healthcare provider.
2. Stabilisation: Airway, breathing and circulation, 100% O₂ administration
3. Antidotes: Amyl nitrite or sodium nitrite makes the cytochrome oxidase free by binding methamoglobin formed by the action with cyanide
4. Other antidotes like dicobalt edetate and hydroxocobalamin
5. Decontamination should be done after stabilising the patient
6. Supportive care should be done

Postmortem findings

❖ Externally

- Postmortem hypostasis bright red/pinkish in colour
- Finger nails are blue
- Eyes are bright, glistening and prominent with dilated pupils
- Froth at mouth and nostrils

❖ Internally

- Cranial cavity is opened first as the bitter almond smell is more evident in brain cells
- On opening the body cavity – odour of HCN is noticed
- Mouth – lips and mouth corroded
- Stomach – odour of bitter almond;
- Mucosa – corroded, haemorrhagic gastritis is seen
- All viscera congested

12.6 Hydrocarbons-Kerosene

Kerosene is a combustible hydrocarbon liquid which is derived from petroleum.

Mode of Action

- ❖ Petroleum distillates are irritants as they dissolve fats.
- ❖ They also depress the cells on the central nervous system.
- ❖ Also adverse effects on liver, kidneys and bone marrow may be from contaminants such as benzene

Kerosene poisoning**Signs and symptoms**

- ❖ Kerosene taste in mouth
- ❖ Burning sensation
- ❖ Nausea, vomiting
- ❖ Colicky abdominal pain
- ❖ Diarrhoea

Chronic poisoning is known to occur from inhalation in persons who handle petroleum products.

Main symptoms:

- | | |
|------------------|-----------------|
| ❖ Dizziness | ❖ Nervousness |
| ❖ Weakness | ❖ Pain in limbs |
| ❖ Anaemia | ❖ Paresthesia |
| ❖ Loss of weight | |

Fatal dose

Ingestion of more than 10 ml kerosene may be fatal.

Treatments

1. Stomach wash with warm water (Sodium Bicarbonate)
2. Absorption slowed by giving 250ml of liquid paraffin orally and saline cathartics.

PM Appearance

- ❖ Kerosene odour
- ❖ Acute gastroenteritis
- ❖ Pulmonary oedema
- ❖ Bronchopneumonia
- ❖ Degenerate changes of liver and kidneys
- ❖ Signs of asphyxia

Medico-legal aspects

- ❖ Suicidal and self-immolation agent
- ❖ Homicidal attempts are also there
- ❖ Most fatalities are accidental. By mistaking it with water by children.

12.7 Agrochemical Poisoning – Organo-Phosphorus Compounds, Carbamates, Organo-Chlorine Com- pounds, Aluminium Phosphide

Organo-Phosphorus Poisoning

Agrochemical compounds: They are the chemicals used for agricultural purposes for the better yield. They may be.

Pesticides: These substances help to control the pest. It is defined as any substance or mixture of substances used for preventing, destroying, repelling or mitigating any pest.

Classification of Pesticides

1. Insecticides
 - Organophosphates
 - Carbamates
 - Organochlorines
2. Herbicides
3. Rodenticide
4. Fungicide
5. Fumigants
6. Acarides
7. Molluscicide
8. Nematicide

Organophosphates

- ❖ Organo phosphorus compounds are used as Pesticides, Vermicides, and Rodenticides.

Chemically

- ❖ Alkyl and Aryl Phosphates.
- ❖ Poisonous effects may be cumulative.

Action of poison

- ❖ These compounds are powerful inhibitors of cholinesterase (acetyl cholinesterase-

neurotransmitter) at the myo-neural junction and synapse of the ganglions.

- ❖ Therefore acetylcholine accumulates at the synaptic junction: there by hyperaction of voluntary and involuntary muscles.
- ❖ A drop of activity of cholinesterase to 30% of normal or lower is associated with toxic symptoms.

Clinical Features

The main toxic effects are

- a. **Muscarinic:** Like (Found at exocrine glands sweat glands, lachrymal glands) smooth muscles, heart, respiratory system, CVS, GIT, CNS and urinary tract system
- b. **Nicotine:** Like (mainly at neuromuscular and neuro neural junction)
- c. **On the CNS**

Muscarine like symptoms are

- ❖ **Bronchial tree:** Tightness in the chest with prolonged, wheezing, expiration, suggestive of bronchospasm. This causes bronchial asthma.
- ❖ **GIT:** Anorexia, nausea, vomiting, abdominal cramps
- ❖ **Sweat glands:** Increased sweating
- ❖ **Salivary glands:** Increased salivation
- ❖ **Lacrimal glands:** Increased lacrimation, Red tears due to porphyrin in lacrimal gland,
- ❖ **Heart:** Bradycardia
- ❖ **Pupils:** Slight miosis
- ❖ **Ciliary bodies:** Blurring or dimness of vision
- ❖ **Urinary bladder:** Involuntary micturition

Nicotine-like effect

1. **Striated muscles:** Easy fatigue, mild weakness, muscular fasciculation, cramps
2. **Sympathetic ganglia:** Pallor, occasional elevation of blood pressure.

3. **Action on CNS:** Irritability, apprehension, restlessness, fine tremors in hand, mental convulsions, coma with absence of reflexes.

Signs and Symptoms

- ❖ Poisoning first affects involuntary muscles, and secretory glands, then voluntary muscles and finally to brain cells.
- ❖ According to the route of entry respiratory or GIT are more marked. Respiratory symptoms more marked as bronchial asthma.
- ❖ Combination of symptoms called **SLUD**
 - Salivation
 - Lacrimation
 - Urination
 - Defecation.
- ❖ Death is mainly due to paralysis of musculature, respiratory failure, circulatory arrest, oedema of lungs and brain,

Fatal dose: 16-170mg

Treatment

1. Supportive therapy
2. Decontamination: Remove the patient from the source of exposure.
3. Care of air way.
4. Administration of antidote --Atropine can be given, to block the muscarinic actions of the poison
5. Administration of cholinesterase reactivators.
6. Other measures – diuretics saline purgatives can be given.

PM changes

- ❖ This suggestive of asphyxia.
- ❖ Externally face is cyanosed.
- ❖ There is froth, blood stained, at the nose and mouth.

- ❖ Kerosene like smell or garlicky smell perceived.
- ❖ Mucosa congested.
- ❖ Patechial haemorrhages may be seen
- ❖ Organo phosphorous compounds as they resists putrefaction and poisoning can be detected in exhumed bodies.

Medicolegal Importance

1. Commonly used in agricultural and domestically as pesticides, fungicides and insecticides.
2. Being available and commonly used as suicidal agent.
3. Homicidal mixing with alcohol to prevent its smell.
4. Accidental deaths are also occurred.
5. Contamination and leakage of these compounds to edible commodities have also been recorded.

Carbamates

Carbamates are a class of insecticides which are similar to organo phosphate insecticides. They are absorbed through the GIT, lungs and skin. They inhibit plasma and red blood cell (RBC), cholinesterase, preventing breakdown of acetylcholine, which then accumulates in synapses. Carbamates are cleared spontaneously within about 48 hours, after exposure.

Carbamates are a class of insecticides which are similar to organo phosphate insecticides except in:

1. Spontaneously hydrolyse from the cholinesterase enzymatic site within 24-48 hrs, whereas organophosphates will not
2. Do not effectively penetrate into CNS

Symptoms of Carbamates poisoning

- ❖ Nausea and vomiting
- ❖ Diarrhoea and abdominal cramps

- ❖ Sweat and salivation
- ❖ Difficulty in breathing and shortness of breath
- ❖ Weakness and fatigue
- ❖ Tremors or muscle twitching
- ❖ Confusion or altered mental state
- ❖ Seizures or convulsions
- ❖ Coma

Lethal dose: It depends on specific type of carbamate, the individual's weight and overall health, route of exposure.

Lethal dose ranges from few milligrams per kilogram of body weight to over 100mg per kilogram, depending on the carbamate type.

Diagnosis: Diagnosis through medical history, physical examination and lab tests (blood level of acetylcholinesterase) can indicate carbamate poisoning. Urine tests and liver function test etc. are also done.

Treatment

- ❖ Administer medicine to reverse the effect of carbamate.
- ❖ ABC, administer medicines to support respiration.
- ❖ Administer medicines to control tremors and seizures.
- ❖ Provide support care.

Organochlorines

Major Organochlorine compounds are –

3. Dichloropropene (D.D.)
4. D.D.T.
5. Endrine – most toxic also known as PLANT PENICILLIN
6. Deldrine

Used as – Insecticide in agriculture purpose.

Signs and symptoms: Toxicity due to ingestion, inhalation and skin contamination.

Symptoms include

- ❖ Salivation
- ❖ Tremors
- ❖ Vomiting
- ❖ Convulsions
- ❖ Abdominal pain
- ❖ Dyspnoea
- ❖ Oozing of white fine froth from mouth and nostril
- ❖ Convulsions, coma then leads to death

Fatal dose

- ❖ 16 gm

Fatal period

1 hours to several hours

Treatment

1. Decontamination
2. Air way management
3. Barbiturates and diazepam for controlling convulsion.
4. Calcium decreases the toxicity of endrine, it can be given 10ml of 10% solution as IV.

PM Changes

- ❖ Asphyxial signs present
- ❖ Kerosene smell externally
- ❖ Fine white, froth near mouth & nose
- ❖ Cyanosis of face, fingers, nails etc.
- ❖ Petechial haemorrhages of lungs
- ❖ Pulmonary oedema
- ❖ Internal viscera congested

Medicolegal Aspects

- ❖ Commonly used as suicidal agent despite its unpleasant taste and painful death.
- ❖ Homicidal also done by mixing with alcohol.
- ❖ Accidental cases are also reported as it is used as an insecticide.

Aluminium Phosphide

- ❖ This is an effective pesticide and rodenticide.

- ❖ Its various names are celphos, Alphos, fumigran and Phostoxin.

Fatal dose

3gm

Medico-legal Importance

- ❖ Easily available and cheap.
- ❖ So it is frequently misused in homicidal intent in cases of dowry death.

Toxicity due to: Liberation of phosphine gas when mixed with gastric juice.

Signs & Symptoms similar to ZnP (zinc phosphide)

12.8 Household Poisons**Common household poisons**

Household poisons occur due to exposure to home products, especially in children because of their ignorance and among adults it is (accidental, or by mistake)

Route of poison:

- ❖ Ingestion
- ❖ Skin contact

Classifications:

- ❖ Medicines
- ❖ Cosmetic/personal care products
- ❖ Cleaning products
- ❖ Pesticides
- ❖ Paint/paint thinners
- ❖ Plants
- ❖ Small batteries

Domestic Poisons

Cosmetics	Toxic contents
Cuticle remover	Potassium hydroxide
Depilatories	Barium sulphide, Thallium
Nail polish remover	Acetone
Suntan lotion	Denatured alcohol, methyl salicylate
Baby powder	Boric acid

Kitchen Toxic items

Baking powder	Tartaric acid
Baking soda	Sodium bicarbonate
Dish washing	Sodium polyphosphate, sodium silicates
Match box	Antimony, phosphorous, potassium chlorate

Rat Poison

Rat paste	Aluminium phosphide, zinc phosphide arsenious oxide
Rodine	Yellow phosphorous

Sanitary

Deodorant tablets	Formaldehyde, Naphthalene
Drain cleaners	Sodium hydroxide
Disinfectants	Phenol

Miscellaneous

Insect spray	DDT
Moth balls	Naphthalene balls

Marking ink	Aniline
Ink remover	Sodium sulphide
Antirust products	Ammonium Sulphide, Oxalic acid, Carbon tetrachloride
Hair bleach	Potassium permanganate
Toys	Lead
Crayons	Para – nitro aniline

Garden Poisons

Insecticides	organo phosphorous, organo chlorines
Fungicides	Lead arsenate

General Treatments

Firstly do decontamination of poison, wash the area with copious amount of water in case of poison in skin, if a poison is a gas must go to the fresh air to breath, in case of ingestion of corrosive poison, must drink water for dilution, and if ingestion of medication or plant, emesis must be done.

Summary**Corrosives**

Corrosives are those substances which corrode and destroy tissues through direct chemical action, it is having both local and systemic action.

Acids and Alkalis: Comes under Corrosive Poisoning.

General Signs and Symptoms

The onset of symptoms are immediate.

Soon after swallowing there will be burning pain in the mouth, esophagus, stomach and duodenum also feeling of intense thirst and difficulty in swallowing vomiting of blood mixed materials.

The vomitus may be acidic or alkaline depends on the acid intake. Bowel becomes

constipated and urine is scanty, but in alkali poisoning there may be tenesmus and frequency of stools with blood and mucus. Dyspnea often present from oedema of the glottis, and is more marked in volatile or strong fuming acids. Collapse from shock sets in with cold clammy skin pale anxious face, sunken eyes, dilated pupil, rapid feeble pulse and sighing respirations. Consciousness is retained until death.

Death occurred due to primary shock, suffocation due to oedema of glottis or perforation of the stomach.

Treatment

Stomach tube administration and emetics are contra indicated

If an acid is taken, alkaline carbonates are contra indicated, weak alkalies and plenty of water or neutralizing agents such as milk and egg albumin should be given. In case of alkali ingestion weak acids such as vinegar will neutralize its effects.

Morphine injection for pain relieving
Intra venous fluid to combat fluid loss

Postmortem Appearance

These may be expressed generally as signs of corrosion and partial destruction of the parts with which the poison has been in contact.

Externally the lips may be burnt, and the trickle marks may be found running from the mouth to the chin neck and chest

Stomach perforation is very common in sulphuric acid poisoning

Vitriolage

This indicates throwing of any corrosives not necessarily Sulphuric acid on a person with malicious intent. These fluids are usually thrown on the face with the intention to cause loss of vision, or causing facial disfigurement and this causes grievous hurt. Sulphuric acid is commonly used for this type of purpose and hence it is called vitriolage.

Asphyxiants

They produce respiratory embarrassment. Important ones are carbon monoxide and carbon dioxide

Carbon monoxide poisoning

It is colourless, odourless gas which initially nonirritating.

It occurs from breathing in carbon monoxide (CO) in excessive levels. Symptoms are often described as flu like commonly includes headache, dizziness, weakness, vomiting, chest pain, and confusion. Large exposure

can lead to loss of consciousness, arrhythmia, seizures, or death.

The classically described cherry red skin, rarely occurs. Long term complications may include chronic fatigue, trouble with memory, and movement problems.

Fatal dose and Fatal period

When a person is at rest 0.1% of carbon monoxide in the atmosphere will result in stupor and coma, in two and half to three hours. A 1% concentration will result in stupor and coma in 15-20 minutes

Postmortem Appearance

Externally fine froth may be seen at the mouth and nose. The colour of the skin especially postmortem staining

- ❖ Skin blisters are seen
- ❖ Brain congested oedematous with petechial hemorrhages

Carbon dioxide poisoning

Heavy, colourless, odourless and poisonous gas which results from complete combustion of carbon containing compounds.

CO₂ inhalation may cause vagal inhibitory action and may cause sudden death. Inhalation of high concentration of CO₂ causes diminished respirations, fall of blood pressure, throbbing headache, drowsiness, coma, and gradual death from pulmonary oedema and hemorrhage. At more than 50% concentration of CO₂ causes immediate unconsciousness with or without convulsions and death results from deficiency of oxygen supply to brain and tissues.

Postmortem Appearance

Marked cyanosis, deep congestion of viscera, dilatation of the pupil, and petechial hemorrhages, froth may be seen at the mouth.

Nonmetallic poisoning- phosphorous

Fatal dose: 60 mg

Mode of Action

Yellow phosphorous – Protoplasmic poison
is a potent hepato-toxin

Large dose: shock / Cardio vascular collapse

Locally: Severe irritation to skin

This signs and symptoms occurs in 2 phases:

1. Primary-due to local irritant action.
2. Secondary-due to the action of the absorbed poison, and there is usually a considerable interval between them.

The primary symptoms usually occurs in 2-6 hours, there is burning pain in the throat, oesophagus and stomach, with intense thirst, nausea, vomiting and diarrhea. The person feels garlicky odour in the breath. Vomitus matter is darkened by blood, smells of garlic and luminous in the dark. Usually symptoms remissions may occur. Liver is enlarged due to fatty degeneration in the last stage.

In chronic poisoning is presented with phossy jaw.

Postmortem Appearance

Presented with highly irritant poisoning.

The contents of stomach or vomitus may be luminous in the dark and the body may be smells like garlic. Externally the body is emaciated and smells like garlic. The toxic effects are well marked in the stomach and intestines. Fatty degeneration of liver and kidney.

Cyanide poisoning

Action in the body

It inhibits the enzyme cytochrome oxidase which badly effects cellular oxidation causing anoxia.

FD: HCN (50mg), KCN & NaCN (250mg)

Fatal period: death can occur within seconds or minutes based on the concentration of HCN.

Hydrocarbons-Kerosene poisoning.

Kerosene Poisoning

Signs and Symptoms

- ❖ Kerosene taste in mouth
- ❖ Burning sensation
- ❖ Nausea, vomiting
- ❖ Colicky abdominal pain
- ❖ Diarrhea

Fatal dose: More than 10 ml Kerosene ingestion is said to be fatal

Postmortem appearance: Kerosene odour and acute gastroenteritis.

Pulmonary oedema and bronchopneumonia are present.

Organophosphorous Poisoning

Organo phosphorous compounds are used as Pesticides, Vermicides, and Rodenticides

Signs and Symptoms

- ❖ **Main toxic symptoms are :**
 - Muscarinic effects
 - Nicotinic like effects
 - On the central nervous system

It affects first in the involuntary muscles and secretory glands, then voluntary muscles and finally vital centres of brain.

Initially complaints of bronchial asthma, headache, malaise, sense of tightness in the chest, and dimness of vision. Later appearance of nausea, abdominal cramps, vomiting, diarrhea, sweating, salivation, frequent urination and muscular twitching, shedding of chromogenic tears due to the accumulation of porphyrin in the lacrimal glands. In severe poisoning pulmonary oedema, coma, convulsions, and possibly death may occur.

PM Changes

- ❖ This suggestive of asphyxia.
- ❖ Externally face is cyanosed.

- ❖ There is froth, blood stained, at the nose and mouth.
- ❖ Kerosene like smell or garlicky smell perceived.
- ❖ Mucosa congested.
- ❖ Patechial haemorrhages may be seen.

Organo phosphorous compounds – resists putrefaction and poisoning can be detected in exhumed bodies.

Household Poisons

Items	Toxic components
1. Babies and children • Baby powder • Crayons • Fireworks • Toys	Boric acid coloured with copper arsenic lead compounds arsenic, antimony, lead., thiocyanate, Phosphorous lead, chromium, copper etc

Items	Toxic components
2. Cosmetics • Cuticle remover • Depilatories • Hair wash • Nail polish removers • Sun tan lotions	Potassium hydroxide, trisodium phosphate barium sulphide, thallium thioglycolate salts, bromates acetone, ethylacetate denatured alcohol, methyl salicylate
3. Kitchen • Baking powder • Baking soda • Dish washing compounds • Domestic gas	Tartaric acid (mild irritant) sodium bicarbonate sodium carbonate LPG
4. Rat poisons • Rat paste • Rodine • Warfarine	Potassium /zinc/aluminium phosphidephosphorus it is a 4 hydroxy coumarine
5. Sanitary • Deodorants • Drain cleaners • Lysol	Fomaldehyde, naphthalene sodium hydroxide phenol

Important Questions MCQ

- Which one is known as plant penicillin?
 - DDT
 - Endrin
 - Aluminium phosphide
 - Organo phosphates
- Stomach mucosa appears blotting paper like in
 - Alkali poisoning
 - Nitric acid poisoning
 - Metallic poisoning
 - Sulphuric acid poisoning
- Liquefaction necrosis is the feature in
 - Acid poisoning
 - Alkali poisoning
 - Metallic poisoning
 - Phosphorous poisoning
- Which of the following IPC section is related with Vitriolage?
 - IPC 326B
 - IPC 319
 - IPC 376
 - IPC 375
- Xanthoproteic reaction is a special feature in
 - Alkali poisoning
 - Nitric acid poisoning
 - Metallic poisoning
 - Sulphuric acid poisoning
- Coffee ground appearance in the vomitus
 - Nitric acid poisoning
 - Carbolic acid poisoning
 - Oxalic acid poisoning
 - Sulphuric acid poisoning

7. Greenish discoloration of urine is seen in

- a. Nitric acid poisoning
- b. Carbolic acid poisoning
- c. Oxalic acid poisoning
- d. Sulphuric acid poisoning

8. In which corrosive poisoning stomach wash or gastric lavage is indicated

- a. Nitric acid poisoning
- b. Carbolic acid poisoning
- c. Oxalic acid poisoning
- d. Sulphuric acid poisoning

9. Phossy jaw is seen in

- a. Nitric acid poisoning
- b. Carbolic acid poisoning
- c. Oxalic acid poisoning
- d. Phosphorous poisoning

10. Cherry red colour of hypostasis is seen

- a. Carbon monoxide poisoning
- b. Carbon dioxide poisoning
- c. Hydrogen cyanide poisoning
- d. Downing

Answer key

1. b

2. d

3. b

4. a

5. b

6. c

7. b

8. b

9. d

10. a

Learning Objectives

- Describe action of poisons, fatal dose, fatal period, signs and symptoms, management, post mortem appearance, and medicolegal aspects of inorganic acids, organic acids and alkalies.
- Describe the fatal dose, fatal period signs and symptoms, management, postmortem appearance and medico legal aspects of asphyxiants, phosphorus and kerosene.
- Describe the fatal dose, fatal period signs and symptoms, management, postmortem appearance and medico legal aspects of agrochemical compounds and household poisons.

Important SAQ

- Explain vitriolage.
- Explain kerosene poisoning.
- Explain household poisoning.
- Explain acid poisoning management.
- Explain alkali poisoning.

Important LAQ

- Explain corrosive poisoning, and their sulphuric acid poisoning and management.
- Explain corrosive poisoning, nitric acid poisoning their management.
- What is vitriolage? Explain the medicolegal aspects.
- Explain asphyxiants and carbon monoxide poisoning.
- Explain phosphorous poisoning.
- Explain agrochemical poisoning and organo phosphorous poisoning.

Substances of Abuse

13.1 Madya and Madatyaya - Alcoholism

Madya is a dravya that causes mada or intoxication. The substance which makes a person to lose his sense following consumption is called madya.

Synonyms

सुरा, हलिप्रिय, हाला, गन्धोत्तम, मदिरा, परिस्नुत, वारुणात्मजा, प्रसन्न, इर।

Nirukti

योनिस्संस्कारनामाद्यैर्विशेषैर्बहुधा च या।

भूत्वा भवत्येकविधा सामान्यान्मदलक्षणात्॥

(Ch.Chi. 24/6)

Madya by its origin, Samskara by its nomenclature it may be of many types, but by its property *madakari*, it is very unitary too.

Derivation

बुद्धिं लुप्यति यद् द्रव्यं मदकारि तदुच्यते॥

तमोगुणप्रधानं च यथा मद्यं सुरादिकम्।

(Sa.Sa.Pu. 4/21)

The substance which causes derangement of the intellect and possesses tamoguna predominantly like madya is considered as madakari.

Gunas of Madya

लघूष्णतीक्ष्णसूक्ष्माम्लव्यवायाशुगमेव च।

रूक्षं विकाशि विशदं मद्यं दशगुणं स्मृतम्॥

(Ch.Chi. 24/30)

Madya guna	Meaning
लघु	Lightness
उष्ण	Hot
तीक्ष्ण	Sharp
सूक्ष्म	Subtle
अम्ल	Sour
व्यवायि	Quick in absorption
आशु	Quick in action
रूक्षं	Dry
विकाशि	Depressant
विशदं	Non-slimy

Gunas of Ojus

गुरु शीतं मृदु श्लक्ष्णं बहलं मधुरं स्थिरम्।

प्रसन्नं पिच्छिलं स्निग्धमोजो दशगुणं स्मृतम्॥

(Ch.Chi.24/31)

Guru, Sita, mrudu, slakshna, bahala, madura, sthira, prasannam, pichilam, and snigdha are the 10 attributes of ojus.

Alcohol, while reaching the hidaya (heart), afflicts the ten attributes of ojus (located in the heart) by virtue of its ten attributes causing mental distortions.

How the Madya guna and ojus guna; counteract each other

Madya guna	Ojus guna
लघु	गुरु
उष्ण	शीत

Madya guna	Ojus guna
तीक्ष्ण	मृदु
सूक्ष्म	बहल
अम्ल	-----
व्यवायि	स्थिर
आशु	प्रसन्न
रूक्षं	स्निग्ध
विकासि	श्लक्ष्ण
विशदं	पिच्छिल

Madatyaya Avastha

Madatyaya Avastha / Stages

Avastha - by Acharya Charaka - 3

1. Prathama
2. Madyama
3. Antya

According to Vagbhata AH - 3

1. Adya
2. Dwitiya
3. Tritiya

According to Acharya Sushruta - 3

1. Purva
2. Madyama
3. Pashchima

Avasthas of Madatyaya / Stages of Intoxication

ओजस्यविहिते पूर्वो हृदि च प्रतिबोधिते ।
मध्यमो विहितेऽल्पे च विहिते तूत्तमो मदः ॥

(Ch.Chi. 24/37)

3 Different stages of Alcoholism

- ❖ **First stage:** Ojus is not affected but the heart gets stimulated.
- ❖ **Second stage:** Ojus is mildly affected.
- ❖ **Last stage:** Ojus is entirely affected to produce the intoxicating effects.

First stage of Alcoholism

प्रहर्षणः प्रीतिकरः पानान्नगुणदर्शकः ।
वाद्यगीतप्रहासानां कथानां च प्रवर्तकः ॥

न च बुद्धिस्मृतिहरो विषयेषु न चाक्षमः ।
सुखनिद्राप्रबोधश्च प्रथमः सुखदो मदः ॥

(Ch.Chi. 24/42-43)

Intake of alcohol results in three stages of intoxication. The first stage is characterised by exhilaration, passion, proper manifestation of the attributes of food and drinks, and creativity of music, song, humour and stories. It does not impair the wisdom and memory and does not cause inability for the senses to perceive their objects. The first stage of intoxication results in sound sleep and post walking feelings of freshness. Thus, this stage of intoxication is conducive to happiness.

Second stage of Alcoholism

मुहुः स्मृतिर्मुहुर्मोहोऽव्यक्ता सज्जति वाङ्मुहुः ।

युक्तायुक्तप्रलापश्च प्रचलायनमेव च ॥

स्थानपानान्नसांकथ्ययोजना सविपर्यया ।

लिङ्गान्येतानि जानीयादविष्टे मध्यमे मदे ॥

(Ch.Chi. 24/44-45)

During the second stage of intoxication, the person often remembers things and often forgets them, his voice becomes inarticulate and confused, and he speaks sense and nonsense simultaneously.

His movement, posture, drinking, eating and talking appropriately and inappropriately become funny.

Third stage of Alcoholism

तृतीयं तु मदं प्राप्य भग्नदार्ढ्यं निष्क्रियः ।

मदमोहावृतमना जीवन्नपि मृतैः समः ॥

(Ch.Chi. 24/48)

In the third stage of alcoholism, the person becomes inactive like a broken tree with his mind afflicted with intoxicating morbidities and unconsciousness. Though alive, he resembles a dead person.

Samanya Madatyaya Lakshana

सामान्यं लक्षणं तेषां प्रमोहो हृदये व्यथा ।

विड्भेदः सततं तृष्णा सौम्याग्नेयो ज्वरोऽरुचिः ॥

शिरः पाश्चांस्थिरुक्कम्पो मर्मभेदस्त्रिकग्रहः ।
ज्वरो विबन्धघस्तिमिरं कासः श्वासः प्रजागराः ।
स्वेदोः

तिमात्रं विष्टम्भः श्वयथुश्चित्तविभ्रमः ।
प्रलापश्छर्दिरुत्क्लेशो भ्रमो दुःस्वप्नदर्शनम् ॥

(A.S.Ni. 6/25)

General symptoms are: Severe delusion, pain in heart, diarrhoea, constant thirst, fever, having both heat and cold feelings, flanks and bone tremors, cutting pain in the vital parts, catching pain in the triangle of the back, obstruction in the chest, blindness or unconsciousness, cough, dyspnea, loss of sleep, excessive perspiration, indigestion, swelling, mental abnormalities, irrelevant talk, vomiting excessive salivation, giddiness and bad dreams.

Madatyaya samanya Chikitsa

सर्वं मदात्ययं विद्यात् त्रिदोषमधिकं तु यम् ।
दोषं मदात्यये पश्येत् तस्यादौ प्रतिकारयेत् ॥
कफस्थानानुपूर्व्या च क्रिया कार्या मदात्यये ।
पित्तमारुतपर्यन्तः प्रायेण हि मदात्ययः ॥
मिथ्यातिहीनपीतेन यो व्याधिरुपजायते ।
समपीतेने तैर्नैव स मद्येनोपशाम्यति ॥
जीर्णाममद्यदोषाय मद्यमेव प्रदापयेत् ।

(Ch.Chi. 24/107-109)

All types of madatyaya are caused by vitiation of all the three dosha. Treatment should be based on dosha predominance. and should be started from location of kapha, followed by pitta, then vata. The ailments caused by drinking alcohol in wrongful manner or in excess quantity or in less quantity can be cured by taking the same alcohol in appropriate manner and quantity.

According to Acharya Sushruta

मदात्यय /Madatyaya are Classified into

1. पानात्यय
2. परमद

3. पानाजीर्ण
4. पानविभ्रम

पानात्यय

Panatyaya is divide into 4 types based on dosha predominance:

1. Vataja panatyaya
2. Pittaja panatyaya
3. Kaphaja panatyaya
4. Sannipata panatyaya

स्तम्भाङ्गमर्दहृदयग्रहतोदकम्पाः

पानात्ययेऽनिलकृते

शिरसो रुजश्च ।

स्वेदप्रलापमुखशोषणदाहमूर्च्छाः पित्तात्मके वदनलोचन पीतता च ॥

श्लेष्मात्मके वमथुशीतकफप्रसेकाः सर्वात्मके भवति सर्वविकारसंपत् । (Su.Sa.U. 47/18)

In Panatyaya caused by vata, there will be rigidity and mild pain in the body parts, catching pain in the region of heart, pricking pain, shivering and headache, in that produced by pitta, there will be more sweating, irrelevant talk, dryness of the mouth, burning sensation, fainting and yellow colour, of the face and eyes. In that caused by kapha there will be vomiting in that produced by all the doshas together, there will be the presence of all symptoms.

परमद

ऊष्माणमगुरुतां विरसाननत्वं श्लेष्माधिकत्वमरुचिं मलमूत्रमसङ्गम् ॥

लिङ्गं परस्य तु मदस्य वदन्ति तज्ज्ञास्तृष्णां रुजां शिरसि सन्धिषु चापि भेदम् । (Su.Sa.U. 47/19)

Increased body temperature, feeling of heaviness of the body, bad taste in the mouth, increase of kapha, loss of taste, non-elimination of faeces and urine and thirst and pain in the head and joints are the symptoms of paramada.

पानाजीर्ण

आध्मानमुद्गिरणमम्लरसो विदाहोऽजीर्णस्य पानज-
नितस्य वदन्ति लिङ्गम् ॥

ज्ञेयानि तत्र भिषजा सुविनिश्चितानि पित्तप्रकोपजनितानि च काराणानि । (Su.Sa.U. 47/20)

Flatulence, vomiting of sour taste and burning sensation during digestion are the definite symptoms of panajirna produced by pitta, which a physician should understand.

पानविभ्रम

हृद्गात्रतोदवमथुज्वरकण्ठधूममूर्च्छाकफस्त्रवणमूर्धरुजो विदाहः ।।

द्वेषः सुरानविकृतेषु च तेषु तेषु तं पानविभ्रममुपशान्त्यखिलेन धीराः । (Su.Sa.U. 47/21)

Pricking pain in the region of the heart and body, vomiting, fever, feeling of smoke in the throat, fainting, more of salivation, headache, burning sensation and aversion to sura (wine) and food are said to be the symptoms of panavibhrama.

Dhvamsaka and Vikshaya

विच्छिन्नमद्यः सहसा योऽतिमद्यं निषेवते ।

ध्वंसको विक्षयश्चैव रोगस्तस्योपजायते ।।

व्याध्युपक्षीणदेहस्य दुश्चिकित्स्यतमौ हि तौ ।

तयोर्लिङ्गं चिकित्सा च यथावदुपदेक्ष्यते ।।

(Cha.Chi. 24/199-200)

If a person who has stopped drinking alcohol and suddenly takes recourse to drinking alcohol in excess suffers from 2 diseases, dhvamsaka and vikshaya. Since such person is already emaciated because of his earlier drinking habits, these two diseases appearing in him are very difficult to cure, their signs symptoms and treatment will not be described appropriately.

Dhvamsaka

श्लेष्मप्रसेकः कण्ठास्यशोषाः शब्दासहिष्णुता ।

तन्द्रानिद्रातियोगश्च ज्ञेयं ध्वंसकलक्षणम् ।।

(Cha.Chi. 24/201)

Excessive salivation, dryness of the throat and mouth, intolerance to noise and excessive drowsiness and sleep are the signs and symptoms of dhvamsaka.

Vikshaya

हृत्कण्ठरोगः संमोहछर्दिरङ्गरुजा ज्वरः ।

तृष्णा कासः शिरःशूलमेतद्विक्षयलक्षणम् ।।

(Cha.Chi. 24/202)

Cardiac disorder, throat disorder, unconsciousness, vomiting, pain in the limbs, fever, morbid thirst, cough and headache, are the signs and symptoms of vikshaya.

Alcoholism

The term alcohol commonly known as spirit is **ethyl alcohol** (C_2H_5OH). In the modern world, alcohol is available in the form of vodka, whiskey, rum, gin, beer, champagne, wine, brandy, etc.

Item	% of alcohol
Absolute alcohol	99.95% alcohol
Rectified spirit	90% alcohol
Methylated spirit	95% of ethyl alcohol and 5% of methyl alcohol
Beer	2-6% of alcohol
Champagne	10-15% of alcohol
Vodka	60-65% of alcohol
Rum, liquor	50-60% of alcohol
Whiskey, gin and brandy	40-45% of alcohol

Alcohol Absorption

Alcohol is directly absorbed from the stomach and small intestine; 20% is absorbed from the stomach and 80% from the small intestine. Alcohol is absorbed immediately after digestion. Maximum concentration of alcohol in blood happens in about 1 hour. Food which is rich in fats and proteins delays alcohol absorption.

Factors that increase alcoholic absorption are: adding soda or carbonated drinks, empty stomach and warm drink.

Distribution

Alcohol is distributed evenly throughout the body, passing the blood brain barrier easily.

Metabolism of Alcohol

- ❖ 90% alcohol is metabolised in the liver, in the liver alcohol is oxidised into acetaldehyde by the enzyme alcohol dehydrogenase (ADH) and its co-enzyme nicotinamide adenine dinucleotide.
- ❖ In the second step, acetaldehyde is oxidised into acetic acid and its activated form acetyl coenzyme -A. Finally acetic acid is converted into CO_2 and water in the citric acid cycle.
- ❖ Excretion
- ❖ The elimination of alcohol occurs mainly through (90%) liver and through oxidation. The rest is eliminated unchanged mainly through saliva, sweat, urine and exhaled air.

Action

Alcohol crosses the blood brain barrier and acts on the nerve cells. Alcohol is a selective depressant, especially higher centers. It depresses the higher centres in the cerebral cortex, which regulates the conduct, judgment and self-criticism. Gradually with increase in concentration, it depresses other centres and the vital centres and finally the centres in the midbrain and medulla which may lead to cardio respiratory failure.

It causes vasodilation and feeling of warmth, but increases heat loss. In moderate concentration, it increases appetite but in higher concentration there will be loss of appetite. It causes diuresis by inhibiting ADH hormone from posterior pituitary. Alcohol induces hypoglycemia by inhibiting the formation of glucose from lactate and other glycogenic amino acids in the liver and stimulates beta cells in the pancreas to produce insulin. Sedatives, tranquilisers, anti-histamines, and barbiturates when given along with alcohol cause synergistic action.

Acute alcohol (ethyl alcohol intoxication)

(See the table down)

Stages of Alcoholism

1. Stage of excitement
2. Stage of incoordination
3. Stage of coma and death

1. Stage of Excitement (50-150 mg% of BAC)

- ❖ In the early stages of alcohol intoxication, there will be a feeling of well-being. There is increased confidence and lack of self-control.
- ❖ Normal good manners are forgotten.

(BAC) Blood Alcohol concentration mg %	Stage	Clinical features
<50	Sobriety	Near normal behaviour, calm
50-100	Euphoria	Feeling of well-being, talkativeness, decreased inhibition, increased self-confidence
100-150	Excitement	Emotional instability, impairment of memory
150-200	Confusion	Disorientation, confusion, vertigo, diplopia, ataxia, slurred speech, staggering gait, +ve Rombergs sign, muscular in coordination, increased reaction time
200-300	Stupor	General inertia, diminished response to stimuli, inability to stand or walk, vomiting, sleep
300-400	Coma	Unconsciousness, abolished reflexes, sub normal temperature, laboured breathing, Mc Ewan's pupil
400-500	Death	Death due respiratory failure

- ❖ The person will be fearless and careless in his activity.
- ❖ He may be adventurous and may disclose secrets
- ❖ Visual acuity is impaired due to dilatation of pupil if the BAC <40mg%
- ❖ There may be jerking movements of eyes, in the direction of gaze is called alcohol gaze. Nystagmus occurs if BAC <50mg%
- ❖ There will be increased desire for sex but the performance will be impaired. The ability to maintain erection and ejaculation are impaired.

2. Stage of Incoordination (150-250 mg% of BAC)

- ❖ When the alcohol content attains a level more than 150mg%/100ml the coordination movements are affected.
- ❖ There will be loss of sense perception and inability to do skilled movement like buttoning and unbuttoning and Picking an object from the ground.
- ❖ He will be irritable, unsteady and quarrelsome.
- ❖ Gait will stagger
- ❖ **Romberg's sign positives**: Romberg's sign is a neurological examination finding used to assess proprioception, which is the body's ability to sense its position in space. In case of alcoholism, Romberg's sign can be positive, indicating impairment in proprioception. This is due to the effect of alcohol on the nervous system particularly on the cerebellum. When Romberg's sign is positive in alcoholism, it means that person has difficulty in maintaining balance between their eyes closed compared to when their eyes are open, suggesting proprioceptive feedback.
- ❖ Sense of touch, taste, smell and hear are diminished.
- ❖ Pupils are dilated and sluggishly react to light.

- ❖ Gradually sleep is induced
- ❖ There may be hypothermia and increased sweating.

3. Stage of coma (more than 300 mg% of BAC)

- ❖ The person may go to a stage of coma at a BAC of more than 300mg%.
- ❖ There will be stertorous breathing
- ❖ The pulse is rapid and temperature is subnormal.
- ❖ Pupils remain constricted, on slapping or pinching on the face causes pupils to dilate and gradually return to constriction (McEwan's pupil).
- ❖ Coma is initially due to hypoglycaemia and becomes irreversible when the cortical centres are affected due to hypoxia in the later stage.
- ❖ If recovery occurs, the coma lightens to deep sleep and person wakes up with depression of mood, nausea, and headache- called alcohol hangover.
- ❖ About 15% of drinkers may experience a blackout, a period of anterograde amnesia, in which the person forgets all or part of what occurred in a drinking session.

Death

- ❖ In a BAC concentration more than 400mg, death may occur due to respiratory failure caused by the hypoxia in the brain.
- ❖ If the victim does not recover from coma more than 5 hours it's a bad prognosis.
- ❖ A highly intoxicated person with unsteady gait may fall and may sustain head injury.
- ❖ An intoxicated person may drowned in shallow water.

Treatments

- ❖ If the person is in coma, supportive measures should be taken and the air way is maintained.
- ❖ Endotracheal intubation and gastric lavage can be done within 2hrs of ingestion.

- ❖ Intra venous administration of 50-100 ml of 50% dextrose should be given.
- ❖ Body should kept warm
- ❖ Metabolic acidosis can be corrected by sodium bicarbonate and respiratory stimulants can be given.
- ❖ Artificial respiration and oxygen inhalation are of great value.
- ❖ Haemodialysis or peritoneal dialysis can be done.

PM findings

- ❖ Internal viscera are congested
- ❖ Lungs are congested and oedematous
- ❖ Smell of alcohol in the stomach
- ❖ PM sample of blood can be collected from the neck veins for alcohol estimation

30ml of blood is collected and sodium fluoride is used as a preservative

Drunkenness

Definition: Drunkenness is a state produced by taking alcohol in a quantity sufficient to make him lose control of his faculties to such an extent to render him unable to execute safely the occupation in which he is engaged at the material time.

The diagnosis of alcohol intoxication is made by BAC (blood alcohol concentration).

Drunkenness and Driving

Driving a vehicle with blood alcohol concentration more than 30mg% is an offence according to Sec.185 of Motor Vehicles Act, punishment is fine up to Rs.2000 and imprisonment of 6 months and on subsequent offence is fine up to 3000 and 2 years of imprisonment.

The following are the causes of accidents involving alcoholic people during driving

- ❖ When a person is driving under the influence of alcohol, he may be overconfident and may drive rashly due to loss of inhibition.

- ❖ The person may have blurring of vision and reduced visual acuity due to dilatation of pupil.
- ❖ The field of vision is reduced.
- ❖ There will be incoordination of muscular movements and the person cannot use the steering, breaks and accelerator with proper co-ordination.
- ❖ Under the influence of alcohol, the reaction time is so prolonged, movements are sluggish and cannot act in time.
- ❖ Loss of orientation due to impaired attention.
- ❖ Sleep may be induced due to the narcotic effects.

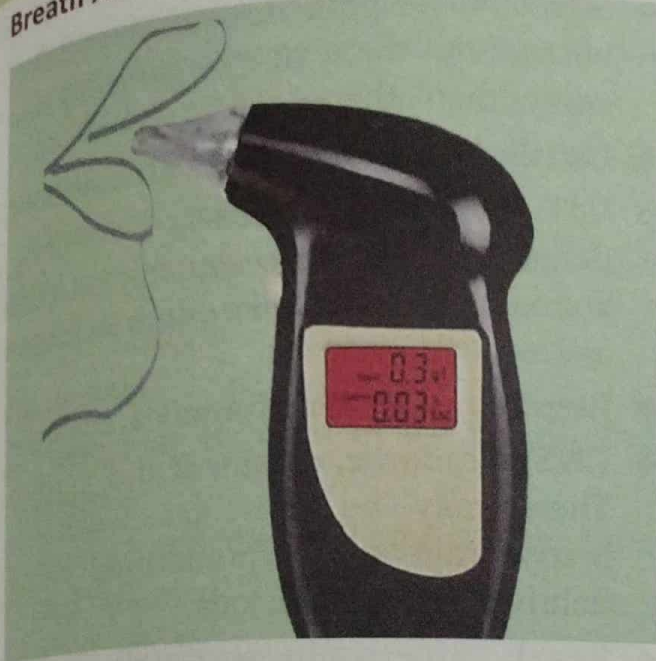
Alcohol and Crimes

- ❖ **IPC 85:** Nothing is an offence done by a person doing a crime in an intoxicated state at the time of crime, incapable of understanding the nature of act provided the thing intoxicated him was administered without his knowledge.
- ❖ **IPC 86:** An intoxicated person is not responsible for the crime in a state of intoxication, unless done with a particular intent of knowledge, and the thing intoxicated him was administered to him without his knowledge.
- ❖ **IPC 510:** Misconduct by a drunken person in public to cause annoyance to any person is punishable imprisonment up to 24 hrs and fine up to 10 rupees or both.

(See Breath Analyzer fig. on next page)

This is a device to estimate the blood alcohol concentration from a breath sample. It is based on the principle that 2100ml of alveolar air contains, the same amount of alcohol as 1ml of blood. The person is asked to blow to the analyzer which contains potassium dichromate solution that oxidizes ethanol to acetic acid and changes its colour at the desired concentration. Infra-red spectroscopic

Breath Analyzer (Breathalyzer)



method is used to analyse the concentration. In this instrument, red light is illuminated at the desired concentration of alcohol.

Chronic Alcoholism

The ill-effects of chronic alcoholism are numerous. It includes gradual physical, mental and moral deterioration of the individual. They suffer from more or less irreversible somatic brain changes due to continued use of alcohol.

Physical and Mental diseases associated with Chronic Alcoholism

Physical	Mental
Loss of appetite, chronic gastritis, wasting, peripheral neuritis, impotence, fatty liver	Loss of memory, impaired judgement
Mallory Weiss syndrome: longitudinal mucosal tear of gastro oesophageal junction and hematemesis which may be fatal	Delirium tremens
Alcoholic cirrhosis and portal hypertension	Wernicke's encephalopathy
Beer cardiomyopathy (munich beer heart)	Korsakoff's psychosis
Pancreatitis	Alcohol hallucinosis

Physical	Mental
Holiday heart syndrome	Alcohol paranoia, alcohol seizures

- ❖ **Delirium tremens:** It is the unsoundness of mind due to long and continued action of alcohol, on CNS in chronic alcoholics.
- ❖ **Wernicke's encephalopathy:** The spinal cord and the brain are affected by chronic alcoholism, vitamin B-1 deficiency is the cause. Characterised by nystagmus, ophthalmoplegia, pappiledema, retinal hemorrhage, and impairment in vision, disorientation, confusion, delirium and stupor may progress to coma.
- ❖ **Korsakoff's psychosis:** Korsakoff's first identified this condition, in 1887. It follows Wernicke's encephalopathy and referred as Wernicke-Korsakoff syndrome.
- ❖ **Cause:** Severe untreated thiamine deficiency is secondary to chronic alcoholism. Clinical features are recent memory is impaired, there is imaginative confabulation, the insight is often impaired and inability to learn, which is called organic amnesic syndrome or alcohol dementia.

Treatment of Chronic alcoholism

To grade alcohol dependence **CAGE questionnaire** is used. Alcohol addicts are the people who can't stop drinking for long or suffer from withdrawal symptoms if they do so. They need treatment.

Disulfiram (tetraethylthiuram disulfide, antabuse)

A single daily dose of 250mg of this is given and gradually it is reduced to 0.125-0.25mg. Disulfiram works by inhibiting the enzyme Aldehyde dehydrogenase, causing many of the effects of a hangover to be felt immediately following alcohol consumption.

Methyl Alcohol – (CH₃OH) / Methanol

Methyl alcohol is 3 times toxic than ethanol. It is obtained by destructive distillation of wood. Also called as wood-naphtha, wood spirit, in pure form it is colourless and smells like ethanol.

Absorption to Excretion

It is rapidly absorbed through the stomach, intestine, lungs and skin.

It is distributed in the tissues according to the water content and high concentration is found in vitreous body and optic nerve. It is oxidised in the liver but the oxidation is 1/5th slower than ethanol. Methyl alcohol is oxidised in the liver first to **formaldehyde** by the alcohol dehydrogenase (ADH) enzyme and then to formic acid by aldehyde dehydrogenase enzyme. Formic acid further oxidised into CO₂ and H₂O.

Action

- ❖ Action is similar to ethanol as it is a CNS depressant. Formaldehyde is 33 times stronger and poisonous than methanol and formic acid is 6 times toxic than formaldehyde.
- ❖ Retinal cells are damaged due to the conversion of methanol to formic acid in retinal cells. (ingestion of formic acid does not cause retinal toxicity as formic acid cannot break the barrier to enter retinal cells).
- ❖ Formic acid may also inhibit cytochrome oxidase chain leading to increase in the lactic acid production to cause metabolic acidosis. Methyl alcohol is hepato-toxic.
- ❖ **Fatal dose:** 60-120ml of methanol.
- ❖ **Fatal blood concentration:** > 100mg%, more than 80mg% is a dangerous level.
- ❖ **Fatal period:** 24-36 hours, death may be delayed for 2-4 days in patients under treatment.

Signs and Symptoms

- ❖ Signs and symptoms are similar to that of ethanol but the toxic symptoms appear earlier than ethanol.
- ❖ Usually the symptom will start in an hour.
- ❖ **GIT:** Includes nausea, vomiting, dehydration, pain or severe cramps in the abdomen and spirit like odour in mouth and nostrils.
- ❖ Respiratory system: dyspnoea, cyanosis.
- ❖ **CNS:** Headache, dizziness and vertigo. There may be muscular weakness, bradycardia and hypothermia, coma, delirium and convulsions.
- ❖ **Renal:** Urine scanty and may contains acetone, formates and lactates. There may be metabolic acidosis due to accumulation of lactic acid.
- ❖ **Ocular:** Visual disturbance may be the early symptom. Person may develop photophobia, blurring of vision, central and peripheral scotoma, and dilated pupil and sudden loss of vision. Blindness is happened by the accumulation of formic acid in the retinal cells and optic nerve.
- ❖ **Pancreas:** Pancreatitis :
 - **Death:** Occurs by the respiratory failure. Survived victim may suffer from complete blindness.

Treatment

- ❖ Gastric lavage should be done with 5% sodium bicarbonate solution in warm water leaving some solution in stomach.
- ❖ Activated charcoal reduces the absorption from the GIT, thereby reduces absorption.
- ❖ Calcium folinate is used to reduce the blood folic acid level. Dose: 50-75mg every 6 hour.
- ❖ Ethyl alcohol 50% in a dose of 60ml should be given orally every 2 hours for 4-6 days. Alcohol dehydrogenase has more affinity

to ethanol than methanol, so methanol without converting, eliminated from the metabolic pathway and eliminated from the body.

- ❖ Sodium bicarbonate (IV) is indicated in severe metabolic acidosis.
- ❖ Haemodialysis is also indicated in critical cases.

PM findings

- ❖ There may be froth in the mouth and nostrils.
- ❖ Stomach and intestinal mucosa congested and inflamed.
- ❖ Brain may be congested and oedematous.
- ❖ Lungs congested and there may be bronchopneumonia.
- ❖ Liver shows fatty degeneration.
- ❖ All other internal organs are also congested; kidney shows tubular degeneration.
- ❖ Brain and viscera are preserved for analysis.

13.2 Addiction—Alcohol, Bhang, Opioids, Tobacco, and Digital Addiction

Addictions are of two types, substance addiction and behavioral addiction. Drug addiction, also called substance use disorder, is a toxic condition or disease that affects a person's brain and behaviour and leads to an inability to control the use of legal or illegal use of drug or medicines. Substances such as alcohol, marijuana and nicotine also are considered as drugs.

Addiction can start with experimental use of recreational drug in social situations, and for some people the drug use becomes more frequent. For other people, particularly with opioid drug addiction begins when they take prescribed medicines or receive them from others who have prescriptions. Some

drugs like opioids pain killers have a great tendency to cause addiction.

Alcohol Addiction

Alcohol addiction is a chronic relapsing disorder associated with compulsive drinking of alcohol, the loss of control over intake, and the emergence of negative emotional state, when alcohol is no longer available. Alcohol use, disorder is a condition characterised by an impaired ability to stop control alcohol use despite adverse social, occupational, or health consequences.

It is a spectrum disorder and can be mild, moderate, or severe. Alcohol addiction refers to the moderate to severe end of the AUD (Alcohol Use Disorder) spectrum. Alcohol like other drugs has a powerful effect on the brain, producing pleasurable feelings and blunting negative feelings. These feelings can motivate some people to drink alcohol again and again, irrespective of its negative effects. So the individual stuck on the unhealthy cycle of alcohol consumption.

(See Chronic Ethanol fig. on next page)

Warning Signs

Warning signs of alcoholism include the consumption of increasing amounts of alcohol, and frequent intoxication, personality changes associated with drinking, loss of appetite, respiratory infections, or increased anxiety.

Alcohol Withdrawal

Withdrawal of alcohol can be fatal if it is not properly managed. Alcohol's primary effect is to increase in stimulation of GABA receptors, promoting CNS depression. With the repeated heavy consumption of alcohol these receptors are desensitised and reduced in number resulting in tolerance and physical dependence. When alcohol consumption is

Potential long-term effects of Ethanol

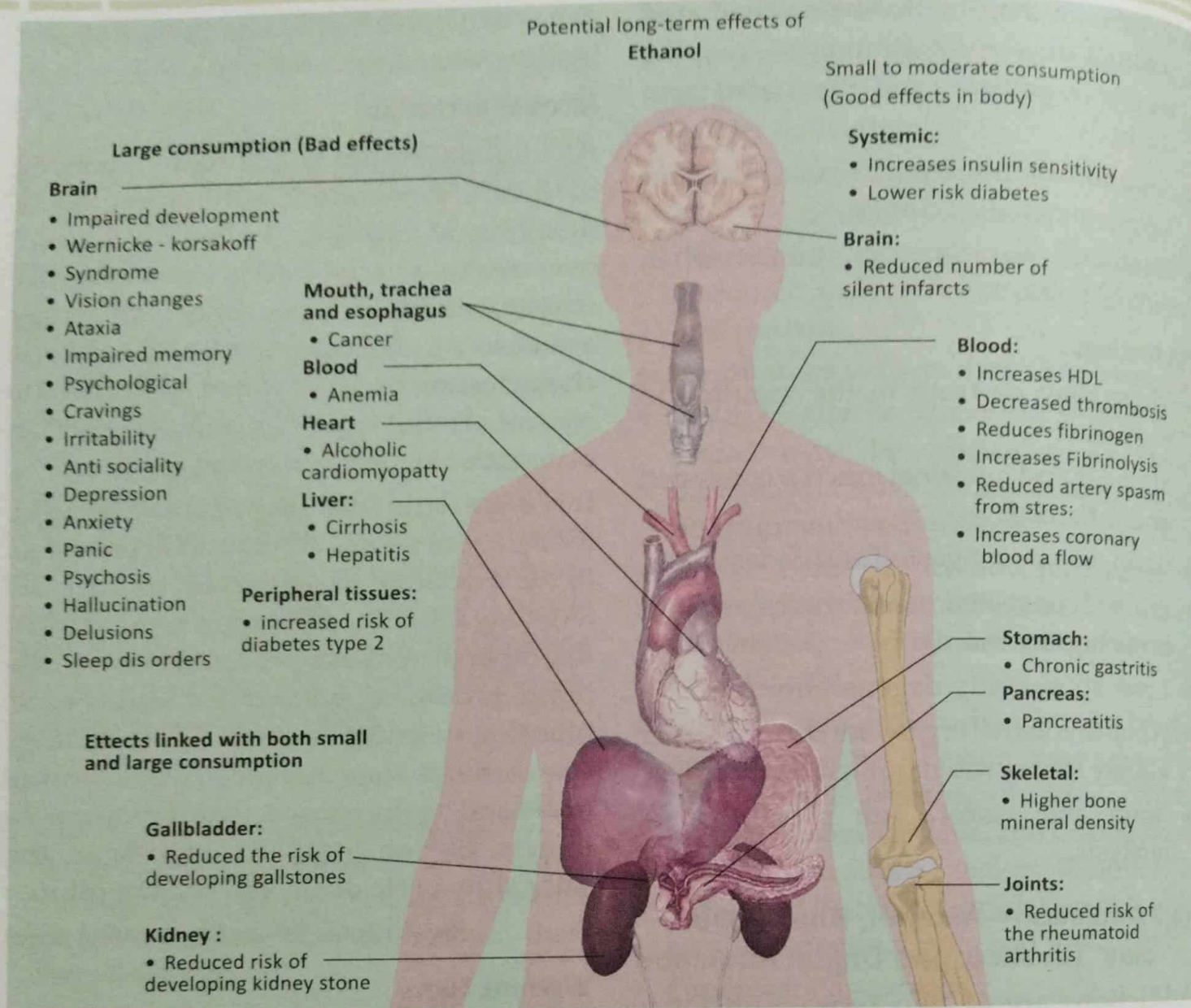


Fig: Chronic Ethanol Poisoning

stopped very abruptly the person's nervous system experiences uncontrolled synapse firing. This results in symptoms that include anxiety, life threatening seizures, delirium tremens, hallucinations, and possible heart failure. Severe acute withdrawal symptoms such as delirium tremens and seizures rarely occur after one week post cessation of alcohol. So the acute withdrawal phase lasts between one and three weeks. In the period of 3-6 weeks following cessation of anxiety, depression, fatigue and sleep disturbances are common.

Bhang Addiction

Bhang addiction is extremely common in the country, where people are not having clear picture of ill-effects due to addiction of bhang. Bhang or cannabis is and a psychoactive drug and can be addictive. Bhang is the edible paste prepared from the leaves of the cannabis sativa plant. In India, it has been consumed by people as a part of religious rituals especially during Holi festival although cannabis is illegal in India. However, consumption of parts of plants other than the leaves can lead to penalty and punishment.

Bhang is addictive and its overdose can cause number of side effects.

Signs and Symptoms of Bhang Addiction

- ❖ Red or bloodshot eyes
- ❖ A constant mucus-filled cough
- ❖ Dry mouth
- ❖ Rapid heart beat
- ❖ Irritability
- ❖ Poor memory and concentration
- ❖ Paranoia
- ❖ Anxiety
- ❖ Loss of control
- ❖ Poor decision making skill and co-ordination

Reason for the Addiction

There are hundreds of chemicals present in the leaves and flowers of cannabis plant. The content present in high concentration in cannabis is delta-9-tetrahydrocannabinol or THC. This makes bhang more addictive. When THC enters blood stream it binds itself to the cannabinoid receptors causing the brain to release feel good chemical dopamine. These strong feelings of pleasure and reward causes the person to get addict on bhang.

Side effects of Bhang consumption

- ❖ Change in the perception due to a small hallucinogenic effect that can create a distorted illusion of face time.
- ❖ Change in mood, leading to feeling of low energy, euphoria or feeling of relaxation.
- ❖ Higher heart rate
- ❖ A reduction in blood pressure
- ❖ Cognitive impairment of memory and concentration.
- ❖ Reduced psychomotor coordination.
- ❖ Feeling of nausea
- ❖ An increase in appetite

- ❖ Insomnia
- ❖ Psychosis

Treatments

- ❖ Supportive measures to cut down the use of bhang
- ❖ Generally depending on the rate of appearance of symptoms anti-anxiety drugs are indicated.
- ❖ Psychotherapy-cognitive behavioural therapy which helps the individual to manage their thinking patterns, especially controlling their negative thought behaviours, that may lead to drug abuse.
- ❖ Motivational enhancement therapy (MET) is often used in bhang addiction treatment.

Opioid Addiction

An opioid addiction is a powerful urge to use certain medicines called opioids. Opioids are the group of medicines, prescribed by a doctor to relieve pain in dental diseases, injuries, surgeries, cancer, etc.

Some opioid Drugs include:

- ❖ Opium
- ❖ Codeine
- ❖ Fentanyl
- ❖ Heroin
- ❖ Morphine
- ❖ Methadone
- ❖ Tramadol
- ❖ Hydrocodone & oxycodone

Strong desire to use opioid medicines or not able to stop the usage is said to be opioid addiction. It is a substance abuse. The signs and symptoms are physical, behavioural and psychological.

Signs and Symptoms

- ❖ Shallow or slow breathing
- ❖ Physical agitation

- ❖ Poor decision making
- ❖ Abandoning responsibilities
- ❖ Mood swings
- ❖ Irritability
- ❖ Depression
- ❖ Anxiety

It may lead to a serious Medical condition when the symptoms are present

- ❖ Slow or irregular breathing or no breathing all.
- ❖ Unresponsiveness (can't wake up).
- ❖ Slow or erratic pulse or no pulse at all.
- ❖ Vomiting
- ❖ Loss of consciousness
- ❖ Small pupil in eyes

Opioid overdose is a serious medical emergency. Nasal spray of naloxone (antidote) is used against it.

Opioid addiction is caused by creating artificial endorphins, besides blocking pain and this hormone makes feel good. So the person wishes to stay in this feel good status gets the addiction. Also, once it is produced like this, brain lowers the production of endorphin. This also makes the person to consume opium more.

Tobacco Addiction

The habitual use of tobacco and tobacco products continues to be a significant contributor to health problems worldwide. Increased availability and its low cost, as well as marketing strategies make tobacco a common substance of addiction. Smoking and chewing are the two important sources of tobacco addiction. Tobacco addiction or nicotine addiction is one of the easiest addiction happened to people and the toughest addiction to get rid of.

Nicotine is a plant alkaloid, found in tobacco plant, Large leaf tobacco plant (*Nicotiana*

tabacum) and small leaf tobacco plant (*Nicotiana rustica*) are the main sources of nicotine.

Causes & Signs and Symptoms

Nicotine is an amine found in tobacco and tobacco plants. It is an addictive agent. When tobacco smoke is inhaled, nicotine rapidly enters the blood stream through the pulmonary circulation. Nicotine readily passes blood brain barrier which then promptly diffuses into brain tissues. This process takes 2-8 seconds from the time of inhalation. Nicotine acutely increases the activity in the prefrontal cortex, thalamus and visual system consistent with activation of cortico-basal ganglia and thalamic brain circuits. Nicotine stimulates the production of dopamine, also norepinephrine, acetylcholine, GABA, glutamate and endorphins. On repeated exposure of nicotine, tolerance develops and causes release of catecholamines and increase in heart rate, cardiac contractility, constricts cutaneous and coronary blood vessels and increase of blood pressure.

Complications:

- ❖ Lung cancer
- ❖ Peripheral vascular diseases
- ❖ Bronchitis
- ❖ COPD/emphysema
- ❖ Halitosis
- ❖ Head and neck cancer
- ❖ Stained teeth

Treatment

1. Nicotine replacement products
2. Nicotine replacement medications
3. Symptomatic relief

Digital Addiction

Digital addiction is a harmful dependence, on digital media and high tech devices. As digital medium (such as internet,

smartphone, social media networks and gadgets) and other online active devices have become more widespread, 28% of global adult, now report that they go online almost constantly, up from 21% in 2015.

Digital Addiction (DA) denotes a problematic relation to the technology described by being compulsive, obsessive, impulsive and hasty. The phrase "digital addiction" is used to pinpoint the possible warning signs for being overexposed to technological gadgets at a time when the rate at which the use of digital gadgets in daily activities is ever increasing and the possibilities of becoming dependent upon them is becoming frightening. It is a primary, and chronic disease affecting brain and the dysfunction of brain leading to characteristic biological, physiological, social and spiritual manifestations.

Problems of Digital addiction

- ❖ Information overload: Too much online surfing leads to decreased productivity at work and fewer interactions with family members.
- ❖ Compulsive addiction: Excessive time spent on the phone or in online activities such as gaming, trading of stocks, gambling and even auctions often lead to overspending and problems at work.
- ❖ Cybersex addiction: Too much surfing of porn site often affects real life relationships.
- ❖ Cyber relationship addiction: Excessive use of social networking to create relationship rather than spending time with family or friends may destroy real life relationships.
- ❖ Virtual addiction
- ❖ Online solicitation

Also categorised as Facebook addiction disorder (FAD), YouTube addiction disorder (YAD), Google search addiction disorder

(GSAD), Widget addiction disorder (WAD), Twitter addiction disorder (TAD) and Blackberry addiction disorder (BAD).

Symptoms of Digital Addiction

An addiction in digital space manifests in both physical and emotional symptoms. The major emotional symptoms are: anxiety, depression and isolation. Major physical symptoms of digital addicts are backache, headache, weight gain or loss, disturbances in sleep, blurred or strained vision, and carpal tunnel syndrome which is one of the most significant symptoms of digital addicts.

13.3 Drugs of Abuse – Lysergic Acid Diethylamide (LSD) and 3, 4-Methylenedioxy methamphetamine (MDMA)

Lysergic Acid Diethylamide (LSD)

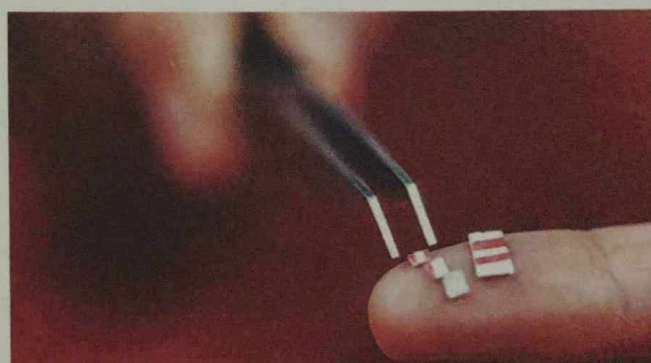


Fig: LSD Paper

Lysergic acid diethylamide, commonly referred to as "Acid" or LSD is a psychedelic **hallucinogen (psycho active drug)** that produces changes in perception, sense of time and space, and mood. LSD is active at very small dose (at around 20 microgram). The drug is most commonly taken orally in the form of tablets, droplets, or blotter paper that is absorbed on the tongue, and then swallowed.

LSD is typically delivered in small pieces of paper. It is difficult to independently assess what constitutes an average dose. This is

based on the fact that different individual reacts to LSD differently. Researches indicate that 20 microgram of LSD is so small that it provides a minimal euphoric effects.

LSD is in the Schedule 1 of Controlled Substance Act (high potential drugs for abuse), and now currently accepted for medical purposes.

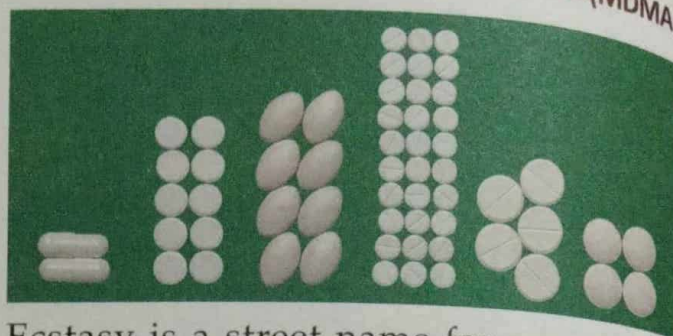
LSD Effects and Abuse

It alters the level of consciousness and perception. During a trip (use), users experience a wide variety of effects. They include:

- ❖ Visual and sensory distortions
- ❖ Changes in thought process
- ❖ Intense emotions
- ❖ Sensory enhancement
- ❖ Delusions
- ❖ Sweating
- ❖ Alienation
- ❖ Dry mouth
- ❖ Visual hallucination
- ❖ Tremors
- ❖ Anxiety
- ❖ Synaesthesia (hearing colours and seeing sounds)
- ❖ Dissociation
- ❖ Impaired depth perception
- ❖ Panic attacks
- ❖ Flashbacks
- ❖ Depression

Tolerance to LSD easily develops, if a specific dose is taken every day for 3 consecutive days, no reaction will be there on third day. The drug abusers must progressively increase the dose to get the desired effect or intoxicated effect that they have previously experienced. This practice is particularly dangerous causing various psychological side effects.

3, 4-Methylenedioxy Methamphetamine (MDMA)



Ecstasy is a street name for a version of MDMA, 3, 4-methylenedioxy-methamphetamine. It is an illegal and artificial drug (schedule 1 of controlled substance) classified as a stimulant with potentially hallucinogenic properties. Molly is another name for MDMA. Both ecstasy and molly are made from MDMA. Ecstasy is used to describe a version in pill or tablet form while molly refers to a white powder or crystalline substance. Ecstasy addiction and abuse can be fatal. Although molly is marketed as a pure form of MDMA, there is no way for users to know what's in it. Both molly and ecstasy may be cut with other ingredients like cocaine, LSD, heroine, amphetamine, caffeine and rat poison.

Ecstasy Effects and Abuse

Ecstasy and molly promote a feeling of well-being, happiness and friendliness. These enhance the user's sense of sight, sound, smell and touch. Ecstasy and molly are available at dance clubs and raves. The effects of ecstasy include:

- ❖ Euphoria
- ❖ Heighted senses
- ❖ Calm and relaxation
- ❖ Long lasting energy
- ❖ Empathy for others
- ❖ Lowered inhibitions

It interferes with brain's pleasure centre and increases natural levels of dopamine. Overdose of ecstasy causes seizures,

foaming at the mouth and increases of body temperature. This can lead to heatstroke or aggravate an underlying heart condition, both of which can be proven fatal. Recognising an addiction to ecstasy can be difficult because the drug lacks obvious withdrawal symptoms and is often used by young people in social settings.

13.4 Narcotic Drugs and Psychotropic Substances Act 1985 (NDPS Act)

- ❖ NDPS Act prohibits production/manufacturing/cultivation/possession/sale/purchasing/transport/storage and consumption of any narcotic drug or psychotropic substances.
- ❖ This Act enacted in 1985 was amended in 1988, 2001 and 2014
- ❖ As per this Act, narcotic drugs include, coca leaf, cannabis (hemp), opium and poppy straw; and psychotropic substances include any natural or synthetic material or any salt or preparation protected by the Psychotropic Convention 1971.
- ❖ Narcotic Control Bureau was constituted in 1986 under the provisions of the NDPS Act.
- ❖ All the offences under this NDPS Act are non-bailable.
- ❖ Amendments: The Act has been amended 3 times and in 2014 amendment erased restrictions on essential narcotic drugs (morphine, fentanyl and methadone) making them more accessible for use in pain relief and palliative care.

More about this Act

India has no legislation against narcotics until 1985. Cannabis and its derivatives (marijuana, hashish, charas and bhang) were legally sold in India until 1985, and their recreational use was there in commonplace. Consumption of cannabis was not seen as socially deviant behaviour, and was viewed as being similar to the consumption of alcohol.

NDPS Act was enacted to fulfill India's treaty obligations under the single convention on Narcotic drugs, convention on psychotropic substances and the United Nation convention against illicit traffic in Narcotic Drugs and Psychotropic Substances.

(See the table next page)

Criticism of NDPS Act

- ❖ The Act has received criticism from various quarters for not distinguishing between soft drugs and hard drugs.
- ❖ Some claim that the same punishment for all drugs leads drug dealers to shift to hard drugs, where they make more profits.
- ❖ Some have criticised the ban on cannabis as the 'elitist'.
- ❖ Some people recommend making the soft drugs legal saying this might reduce heroin addiction. However, its counterclaim is that soft drugs are gateway drugs and its usage would increase the chances of the person using hard drugs later on.

Summary

Madatyaya

Madatyaya comprises two words mada and atyaya. It is the over excitement caused by consumption of alcohol.

Alcohol, while reaching the hridaya (heart) afflicts the ten attributes of ojus (located in the heart) by virtue of its ten attributes giving rise to mental distortions.

Punishment

Quantity at Play	Definition of Small and Commercial quantities:		
	Drug	Small	Commercial
Act now defines three categories: 'small quantity', 'commercial' and 'more than small but less than commercial'. Penalties for possession: Small quantity. Up to 1 year rigorous imprisonment or fine up to 10,000 or both. Commercial quantity 10-20 yrs RI and fine of 1-2 lakh More than small quantity but less than commercial quantity Up to 10 years RI, fine up to 1 lakh	Stimulants:		
	Amphetamine	2g	50g
	Cocaine	2g	100g
	Hallucinogens:		
	Charas/hashish/marjuana/cannabis)	100gm	1kg
	Ganja	1kg	20kg
	Lysergic Acid diethylamide (LSD)	0.002g	0.1g
	Narcotics:		
	Morphine, Heroin (smack/brown sugar)	5g	250g
	Fentanyl	0.005g	0.1g
	Diazepam, methaqualone (Mandrax)	20g	500g
	Methamphetamine	2g	50g
	MDMA (ecstasy	0.5g	10g
	Opium	25g	25kg
	Buprenorphine, semi- synthetic opiod	1g	20g
	Codeine	10g	1kg
Provision for addicts: Small quantity in possession attracts immunity from prosecution	Consumption is an offence under Sec 27 of NDPS Act and punishable with imprisonment of up to 1 year (in case of some drugs) or six months (for all other drugs)	However, addicts volunteering for treatment get immunity under section 64A of the Act	

Stages of Madatyaya

1. Prathama mada
2. Dwithiya mada
3. Thritya mada

3 Different stages of alcoholism

First stage: ojus is not affected but the heart get stimulated.

Second stage: ojus is mildly affected.

Last stage: ojus is entirely affected, to produce the intoxicating effects.

According to Sushruta Samhita

1. Panaatyaya
2. Paramada
3. Paanaajeerna

4. panavibhrama

Stages of Alcoholism

Stage of Excitement

Person is euphoric, emotions are less restrained, increased confidence, poor concentration, impairment in the judgement and memory.

Stage of incoordination

Person may become cheerful/irritable/ill-tempered. Incoordination of fine and skilled movements alteration in speech, nausea, vomiting, flushed face, rapid pulse, hypothermia, breath smells of alcohol, pupils dilated.

Stage of Coma

Thick, slurred speech, becomes giddy, stagger and fall, rapid pulse, hypothermia, pupils contracted, McEwans sign positive

Alcohol and Crimes

IPC 85: nothing is an offence done by a person doing a crime in an intoxicated state at the time of crime, incapable of understanding the nature of act provided the thing intoxicated him was administered without his knowledge.

IPC 86: an intoxicated person is not responsible for the crime in a state of intoxication, unless done with a particular intent of knowledge, and the thing intoxicated him was administered to him without his knowledge.

IPC 510: misconduct by a drunken person in public to cause annoyance to any person is punishable imprisonment up to 24 hrs and fine up to 10 rupees or both.

LSD (Lysergic Acid Diethylamide)

It is hallucinogenic drug that can be derived from the ergot alkaloids, as ergotamine, ergonovine.

LSD is usually synthesized in laboratories, which is similar to that ergot alkaloids. LSD produces marked deviation from the normal behavior, which inhibit the action of serotonin.

LSD after administration readily absorbed from the mucus membrane this acts within 30-60 minutes. Effects are usually lasts for 8-10 hours. Two serious side effects are transient reappearance of Psychotic reactions.

MDMA

Ecstasy is a street name for a version of MDMA, 3, 4-methylenedioxy-methamphetamine. It is an illegal and artificial drug (Schedule 1 controlled substance) classified as a stimulant with potentially hallucinogenic properties.

Patients with MDMA toxicity present with central nervous system, cardiovascular, gastro intestinal, skin and other disease manifestations.

NDPS ACT

- ❖ NDPS act prohibits a person from the production/ manufacturing/ cultivation/ possession/ sale/ purchasing transport storage and or consumption of any narcotic drug or psychotropic substances.
- ❖ This act enacted in 1985 and was amended three times in 1988, 2001 and in 2014.
- ❖ As per this act narcotic drugs includes coca leaf, cannabis(hemp), opium and poppy straw; and psychotropic substance includes any natural or synthetic material or any salt or preparation protected by the psychotropic convention 1971.
- ❖ Narcotic control bureau was constituted in 1986 under the provisions of the NDPS act.
- ❖ All the offences under this NDPS act are non-bailable.
- ❖ **Amendments:** The act has been amended 3 times and in 2014 amendment erased restrictions on essential narcotic drugs (morphine, fentanyl, and methadone) making them more accessible for use in pain relief and palliative care.

Important Questions MCQ

1. The rasa of madya is

- a. Madhura
- b. Amla

- c. Katu
- d. Kashaya

2. Gunas of madya are similar to & opposite to

- a. Ojus & visha
- b. Visha & ojus

- c. Ganja & bhang
d. Bhang & ganja
3. Ojus is not affected in which madatyaya avstha
a. Prathama c. Tritiya
b. Dvitiya d. Chaturtha
4. The person appears as dead even if he is alive in which stage of madatyaya
a. Prathama c. Tritiya
b. Dvitiya d. Chaturtha
5. The person who has stopped consumption of alcohol and restarted may suffer with
a. Panatyaya c. Dvamsaka
b. Vikshaya d. b & c
6. % of alcohol in rectified spirit is
a. 99 c. 95
b. 90 d. 2-6
7. Enzyme in the liver is involved in the metabolism of alcohol
a. Lipase
b. Acetyl cholinesterase
c. Alcohol dehydrogenase
d. Chymotrypsin
8. McEwan's sign is positive in
a. Cannabis poisoning
b. Digital addiction
c. Alcoholism
d. Opium intoxication
9. Drunken person causing public nuisance is punishable under
a. IPC 84 c. IPC86
b. IPC 85 d. IPC 510
10. Which vitamin deficiency causes thiamine deficiency in Wernicke's encephalopathy?
a. Thiamine c. vitamin B1
b. vit C d. both a& c
11. The drug is known as molly or ecstasy
a. LSD c. Cannabis
b. MDMA d. Opioid

Answer Key

1. b 2. b 3. a 4. c 5. d 6. b 7. c 8. c 9. d 10. d 11. b

Learning Objectives

- Define mada, its stages, madatyaya, mode of action of madya, fatal dose, fatal period, signs and symptoms, management, postmortem appearance and medico legal aspects of ethanol and methanol poisoning.
- Explain the alcohol withdrawal and its Ayurvedic approach.
- Describe the signs & symptoms, and withdrawal symptoms of bhang (cannabis), ahiphena (opium), tobacco, LSD, MDMA with its Ayurvedic approach
- Describe the research updates of substance of abuse, describe NDPS Act.

Important SAQ

- Explain differences between madya and ojus.
- Explain Panatyaya.
- Explain Stages of madatyaya.
- Explain dvamsaka and vikshaya.
- Explain madatyaya chikitsa.

Important LAQ

- Explain stages of alcoholism.
- Explain madatyaya and its treatment.
- What is substance abuse?
- Explain NDPS Act.

Agadatantra Perspectives on Cancer

14.1 Toxic Carcinogens

Carcinogens – Toxic carcinogen

Carcinogens are the substances that increase the risk of cancer. Carcinogens are of physical substance such as ultra violet rays, chemical such as asbestos and biological such as certain virus causing infections. Experts have identified more than 100 carcinogens. Simply the contact of carcinogen does not cause cancer always. In fact, when a carcinogen changes the DNA, it triggers a chain reaction that turns normal cells into cancerous cells. Sometimes, carcinogens do direct damage to DNA and changes it normal working. If left untreated, the damaged DNA may lead to changes called **mutations** in certain genes. Depending upon the specific mutation or change, genes may start giving cells instructions to multiply uncontrollably, becoming cancerous tumors or blood cancer. But cancer doesn't develop right away. Carcinogens build up overtime. It may take years before carcinogen in your

body begins the chain reaction that leads to cancer.

Carcinogens – Major types

(See the table down)

When a body comes in contact with the carcinogens, they are processed or metabolised differently, according to this they are classified into:

1. Direct acting carcinogens
2. Indirect acting geno-toxic carcinogens
3. Co-carcinogens

Direct acting carcinogens are those chemicals which cause cancer on exposure like nitrogen mustard. Indirect acting geno-toxic carcinogens are those substances which cause cancer when metabolised in the body like pyrene, aflatoxin, and the co-carcinogens are chemicals or the lifestyles which act with other chemicals to cause cancer. These substances do not causes cancer by themselves like sodium arsenate and cigarette smoking.

Physical carcinogens	Chemical carcinogens	Biological carcinogens
UV rays from sun, ionizing radiation from x-rays and other medical imaging techniques	Asbestos, tobacco smoke, beverages contain alcohol, aflatoxin (a fungus that contaminates foods) and arsenic that appears naturally in the air, water and soil	Such as infections from certain viruses, bacteria or parasites

Exposure of Toxic carcinogens

Exposure of toxic carcinogens causes cancer. This occurs through :

- ❖ The environment
- ❖ Specific lifestyle choices
- ❖ Certain medical treatments
- ❖ Some Infection

Toxins Causing Cancer

1. **Food:** Additives and contaminants
2. **Tobacco (tamraparni):** Causes cancer in digestive system and respiratory system.
3. **Ethanol:** Liver and oesophageal cancer.
4. **Arsenic exposure:** Causes skin and lung cancer.
5. **Polycyclic hydrocarbon:** Cancer of lungs, and skin.
6. **Alkylating agents:** Acute myelocytic leukemia.
7. **Asbestoses:** Lung cancer.
8. **Sunlight (UV light):** Skin cancer.
9. **Pesticides:** Lung cancer and skin cancer.
10. **Nitrogen mustard gases:** Cancer of nasal sinuses and lung cancer.

14.2 Toxicities due to chemo and radiotherapy and its Ayurvedic approach

Cancer is the second largest non-communicable disease after ischemic heart disease. Cancer chemotherapy involves the usage of cytotoxic drugs and hormones. Toxicities due to chemo and radio therapy are said to be a grave problem for cancer patients. Clinically useful antineoplastic agents are more toxic to the sensitive malignant cells than to the normal cells of tumor bearing host.

Cancer- Chemotherapy side Effects

Most of the patients develop side effects to chemotherapy and radiotherapy. Cancer cells tend to grow fast and chemical drugs (chemotherapy) kill fast growing cells. But to attain the desired effects, the drugs have

to go throughout the body to affect or kill the normal cells that are fast growing. Healthy cells also grow fast. Damage caused to these healthy cells causes side effect.

The normal cells commonly affected by the chemotherapy are:

- ❖ Blood forming cells in the bone marrow.
- ❖ Hair follicles
- ❖ Cells in the mouth, digestive tract and reproductive system.

Some chemo drugs can damage cells in the heart, kidney, bladder, lungs and nervous system.

The common side effects of chemotherapy:

- ❖ Fatigue
- ❖ Hair loss
- ❖ Easy bruising and bleeding
- ❖ Infection
- ❖ Anemia
- ❖ Nausea and vomiting
- ❖ Appetite changes
- ❖ Constipation
- ❖ Diarrhoea
- ❖ Mouth tongue and throat problems such as sore and pain with swallowing.
- ❖ Peripheral neuropathy or other nerve problems such as numbness, itching and pain.
- ❖ Skin and nail changes such as dry skin and colour changes.
- ❖ Urine and bladder changes and kidney diseases.
- ❖ Weight changes
- ❖ Mood changes
- ❖ Changes in libido and sexual functions
- ❖ Fertility problems

Radiation Therapy Toxicities

Ionizing radiation (IR) is used to treat 60% of cancer patients. Most of the patients tolerate treatment but 5-10% of patients may suffer

with serious toxicities. The major risk factors includes age, concurrent chemotherapy and anatomical variations from factors such as congenital malformations, postsurgical adhesions, fat content and tissue oxygenation, or the concurrent disease such as diabetes and auto immune diseases like SLE. In rare cases the sensitivity towards radiation can develop to specific genetic mutations. Ionizing radiations generate free radicals which damages vital cellular components can lead to double stranded DNA breaks, resulting in chromosomal aberrations and rearrangements. This lethally damaged cells may continue to divide a limited number of times before undergoing mitotic or apoptotic cell death. Normal cell can repair DNA damage than tumor cells. There are two types of side effects-acute and delayed complications.

Acute radiation damages predominantly involve rapidly proliferating cells, e.g., epithelial surface of skin or digestive tract. Radiation damages the stem cells which manifest when tissues are lost from normal behaviour. But there is insufficient stem cells due to radiation damages. This results in break in protective barrier- commonly in the skin, oral mucosa, and GIT, especially in 1-5 years within the completion of radiation therapy. When acute damage fails to heal completely, leads to late complications. These are commonly seen in the regimens where chemotherapy in combination with radiation therapy are given and tissue fails to repair due to concomitant cytotoxic effects from chemotherapy. Late complications mainly appear in the tissues where there is slow turnover; example: brain, kidney, liver, the wall of the intestine, subcutaneous tissue, fatty tissue and muscle.

Major Chemotherapy drugs	Main Complication
Taxanes	Causes GIT toxicity like stomatitis, vomiting nausea and diarrhoea
Oxaliplatin	Causes gastro-esophageal reflux, constipation, stomatitis, dyspepsia
Anthracyclins	Causes ulceration of esophagus, tongue, anorexia, stomatitis
Cytarabine, Gemcitabine	Oral, anal inflammation or ulceration, bowel necrosis, pancreatitis, hepatic dysfunctions
Methotrexate	Pharyngitis, melena, GIT ulcerations

Area affected due to Radiation	Major Complications
Skin and mucosa	Acute responses include erythema, inflammation and desquamation, mucositis, pruritis (itching), hypersensitivity and ulcers
Salivary glands	Swelling and tenderness after the first dose of treatment, progressing to xerostomia, subsequent severe dental caries and osteonecrosis, eating and speech difficulties
Nervous system	Fatigue, loss of appetite, nausea, vomiting, headache, hearing loss, acute encephalopathy (rare), neuro-endocrine disorders
Lungs	Congestion, cough, dyspnoea, fever, chest pain, pneumonitis, hypoxia
Heart	Acute pericarditis, pericardial effusion, valvular dysfunction, myocardial fibrosis, it increases the risk of ischemic heart disease, coronary artery stenosis
GIT	Anorexia, nausea, vomiting, abdominal cramps, diarrhoea, mal-absorption, ulceration rectal bleeding, fistula etc.
Gonads	Ovarian affection leads to Infertility, PCOS In males, radiation causes impotence and testicular dysfunctions

Ayurvedic Approach

All drugs used for chemotherapy and radiotherapy are ushna and tikshna as per Ayurveda. This is the reason for these many complications occurring after the therapy. Also person's bala/body strength (immunity) is poor.

Two aspects of cancer can be considered here as per Ayurveda:

1. Causative agent/carcinogen damage or poisons the healthy cells.
2. The common treatment usually given for cancer is radiation and chemotherapy, which are already toxic and cause many complications.

These two aspects are very much related with agadatantra.

In Ayurveda, all cancerous growths are described under *Arbuda* and malignancies are considered as *tridoshika* and *asadya* (incurable) presentations of the disease. After surgery, radiotherapy and chemotherapy are commonly administered in such cases. Radiotherapy and chemotherapy may also prevent the metastasis and regeneration of cancerous tissues in operated patients. Radiotherapy and chemotherapy usually cause damage to the normal cells, which is evident in the form of adverse reaction. In severe adverse reaction (class, 1) severe due to overexposure, severe morbidity or death may occur. Class 2 radiation may causes the degradation of quality of life. Class 3 radiation may cause mild transient, and irreversible reaction. After radiotherapy, acute adverse reactions like nausea, vomiting, skin reaction, mucocitis and fatigue occur. Among the chronic and long-term effects, xerostomia, tastelessness, edema and damage to other organs may occur.

Many research works here been done with Ayurvedic management styles to reduce the side-effects due to radiation and chemotherapy.

Rasayana/rejuvenation therapy in Ayurveda is a unique contribution that provides multidimensional effects having *vayasthapana* (anti-aging), *balya* (strengthening), *jeevaneeya* (improving vitality), and other properties to nourish dhatus and restoring the basic homeostatic balance. Also, the medicines containing the drugs like amalaki (*Embolia officinalis*), ashwagandha (*Withania somnifera*), guduchi (*Tinospora codifolia*), yastimadhu (*Glycyrrhiza glabra*), jivanti (*Leptadenia reticulate*), tulasi (*Ocimum sanctum*) and pippali (*Piper longum*) are also useful.

The following Agada formulations can be used against side effects of chemo and radiotherapy complications due to its properties against ushna teekshna gunas and vishahara properties :

- ❖ Padmaka ghrita: Padmaka swarasa, durva swarasa, anantamoola, ghrita having vishagna properties.
- ❖ Vishaghna and Raktaprasadaka drugs: Like Sariva, manjishta, kakamachi, kakamachi and Ushira.
- ❖ Vishaghna mahakashaya: Vishaghna dasaimani, Haridra, Manjishta, Suvaha, Sookshmaila, palindi, Chandana, kataka, sirisha, Sinduvara and Sleshmataka.

Agada and Visha Dravya Prayoga in the Prevention of Cancer

1. **Arka:** It possesses anticancer property against pancreatic cancer. Also, It has anti-tumor property.
2. **Snuhi:** It has anticancer property against renal carcinogenicity.
3. **Bhanga:** It is Effective against prostate cancer.
4. **Bhallahaka:** It has anticancer property against liver cancer and breast cancer and has laryngo-pharyngeal activity.

5. **Arsenic trioxide:** It is effective against acute Promyelocytic leukemia.

14.3 Agada and Visha Dravya Prayoga in Prevention and management of Cancer along with its Research Updates

1. In agadatantra, if we consider Dushivisha, Gara and Viruddhahara concepts most of the etiological factors and pathology of cancer come under these three headings.

Dushivisha

It is a type of poison originating from inanimate or animate sources or any artificial poison (Kritrima visha) retained in the body after partial expulsion or which has provisionally undergone detoxification, by the anti-poisonous drugs, forest fire, the wind or the sun is termed Dooshivisha (Latent poison). Due to the low potency of this poison, it usually won't cause sudden death. Also, due to the enveloping (avarana) action by Kapha, this low potency poison is retained in the body for long without producing any grave or fatal symptoms. Dushivisha slowly vitiates the dosha and then vitiates rasaraktadi dhatu (tissue).

Same pathology is seen in cancer disease. After long-term exposure to carcinogenic substances, Rasaraktadi Dhatu (tissue) gets vitiated which causes the mutation of cells.

Viruddha and gara

The substances which cause 'utkleshya' of the doshas but not able to remove it from the body constitutes Viruddha. It is also antagonistic to the dhatus. The dravyas which are incompatible with the dhatu of the body are viruddha. Some act adversely due to their mutually contradictory properties, some by combinations, some by method of preparations, some by virtue of the place, time, dose and some by their

nature. According to Vagbhata, viruddha is so intimately related to 'Amavisha' that it leads to symptoms of poison. Ahara which is viruddha in nature is like visha and gara. Considering these, we can infer that frequent exposure to carcinogens and unwholesome food habits are etiological factors of cancer. So we can treat this type of diseases effectively by the principles of Agadatantra.

General Concept of Management

- ❖ The administration of Agadas along with general management gives more good result than administration of Agada alone. In all type of cancer, visha in the form of Ama is present. So 'Ama nirharana' is the initial or first line management of all types of cancer. Sodhanam, Langhanapachanam and Langhanam are the treatment for prabhutha, madhyama and alpa dosha respectively.
- ❖ But in the case of cancer, patient is very weak due to the disease. So sodhanam and langhanam should not be advisable. We can do mridulanghana and pachana, for that 'Sasundilajapeya' is given along with mild pachana oushadhas like Drakshadi Kashyam. After getting some 'bala' to the patient strong amapachana drugs like pachanamrutham Kashayam, Sapthasaram Kashayam, etc. can be given.
- ❖ Pathyakrama stated in Visha chikitsa should be followed. Non-veg food, Guru Ahara, Oily foods, etc. Increase the Ama and thereby help the progression of disease. There is a great need of Amino acids for the growth and proliferation of Tumour cells and for Neovascularization (Angiogenesis). So all protein diet should be avoided. Peyadi is only advisable. Specific Agada preparations are given along with this treatment protocol.

Special Agada Formulations

- ❖ **Vilwadi agada:** Hepato protective, radiotoxicity protection.
- ❖ **Kalyanaka ghrita:** Radio toxicity protection.
- ❖ **Ajithagadam:** Nephro toxicity protection.
- ❖ **Malatyadi agada:** Hemotoxicity protection.
- ❖ **Dhvaswakarnadi, patala paribhadradi, kataka beeja:** Promising water pollution controller.
- ❖ **Vilwadi agada:** Protection against *Vibrio cholerae* ciprofloxacin.
- ❖ **Dushi vishari agada:** Acts against lichen planus.
- ❖ **Bhunimbadi agada, dushivishari agada:** Kills *ecoli*, *staphylococcus aureus*, *shigella sonnei*, *salmonella enterica*.
- ❖ **Dhatakyadi agada:** Kills *ecoli*, *staphylococcus aureus*, *streptococcus mutans*.
- ❖ **Sirisha punarnava, tulasi:** Good in reproductive and developmental toxicity.

Reference:

World Journal of Pharmaceutical and Medical Research

Scope of Ayurveda In Oncology: A Review

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Abstract

Cancer is the one word which is very scary for every human being. Every year about 8,00,000 new cancer patients get registered with the national cancer registry program in India. Though heredity plays its role in causing cancer but that includes only 5% of cancer cases, non-heredity factors such as life style, food, level of physical activity, personal hygiene and environmental pollution are the major causing factors. Due to these factors, toxins get accumulated in body,

day-by-day, called as cumulative toxins in Ayurveda, it is nothing but dushivisha, Ayurveda is divided into eight branches and Agadtantra is one of them. In this branch, treatment of poison is explained and it is done by Shodhana (purification) method followed by various agada kalpas which are described in samhitas for the treatment vishas (poison).

Keywords: Cancer, cumulative toxins, dushi visha, agada kalpas.

Gara Visha Concepts in Toxicity induced Hepatocellular carcinoma

Hepatocellular carcinoma is the primary malignancy of liver. It is the third leading cause of cancer death world-wide. Annual mortality and incidence are virtually identical due to its high case fatality rate. Its incidence in India among male accounts for 0.7 to 7.5 and for female 0.2 to 2.2 per 100,000 population per year. The major causative factors for HCC are:

- ❖ Hepatitis B & C infections
- ❖ Non-alcoholic Steatohepatitis
- ❖ Alcohol induced hepatitis
- ❖ Aflatoxin toxicity etc.

Aflatoxins are food contaminants produced by fungi *Aspergillus flavus* and *Aspergillus parasiticus*. The main food sources of its contamination are maize, dried fruits, meat, spices, oil seeds and milk. The Aflatoxin toxicity detected in milk by FSSAI milk survey in recent days reminisces the importance of daily toxic exposure to human beings. Both toxicity and carcinogenicity is being studied experimentally for which acute aflatoxicosis results in death. Chronic aflatoxicosis mainly includes prolonged pathologic changes in liver including cancer and immune suppression. The basic mechanism of action of this toxicity includes

tumor promotion or progression, i.e. activation of proto oncogenes and mutation in tumor suppressor genes-p53

Hepatocellular carcinoma	Gara visha
Weight loss reduced appetite nausea and vomiting	Krsha Alpaagni
Fever	Kasa Swasa Jwaraadi
Right upper quadrant pain	Pratiloma gati of Vayu
Anemia bleeding tendency	Pandu
Feeling of exhaustion	Durbala Alasa Deena Vak
Ascites	Mahodara
Hepatomegaly and splenomegaly	Yakrt Pliha Roga
Ankle edema and feeling of fullness	Sopham Adhmana Suska Pada Kara, Kshayi
Jaundice chalky white stools and darker urine	
Pruritis	
Hard to detect as symptoms don't appear until progress significantly	Chirata Chiratharat Cha

The Treatment includes

❖ Shodhana Chikitsa

- **Vamanam:** To expel out the not metabolised toxic substances in the stomach.
- **Virechanam:** Biopurification that enhances toxicity elimination at cellular level and helps in stopping mutation process through actions at check points.
- **Samana Chikitsa:** Murvadi Churnam helps in metabolic correction through action at Dhatu level (Dhatvagni Mandya) as liver is the primary target organ or toxicity.
- ❖ **Dushivishari Agadam:** While analysing the drugs of the yoga, the main ingredient piperine helps in inhibiting the cytochrome p450 and enhances the

bioavailability of drug. Almost all the drugs have anti-cancerous properties with some hepato-protective in nature such as Kushta Eladi. The probable mode of action as explained by Susrutha Acharya in Nibandha Sangraha teeka as samana and prasadana.

Ayurvedic treatment: Options are very unique for disease prevention and to disrupt its further progression. The basic principle of Ayurveda Chikitsa lies in Agni correction or Amapachana which can be said how as metabolic correction. Vaishwanara Churnam is one among those that help in correcting Agni thereby correcting the metabolic function of liver. In fact, Amapachana or elimination of toxicity from our body is the basic of all our treatments and Agadatantra is a branch of science contributing formulations having magical actions. Various combinations of drugs have proven their hepato-protective activity and also found helpful in hepatocellular regeneration. In Madatyaya Chikitsa, enormous amount of Yogas has been elaborately mentioned that facilitates the quick elimination of acetaldehyde and preclude alcohol induced liver injury.

Reference

Journal of Ayurvedic and Herbal Medicine:

A Review Article on Toxicity Induced Hepatocellular Carcinoma: Through Gara Visa perspective

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Abstract

Hepatocellular carcinoma is the most common primary malignancy of liver in

adults and is the common cause of death in people with cirrhosis. The majority of this disease occurs over pre-existing chronic liver cirrhosis but the increased changes in living conditions, food habits and sedentary life style has emerged the disease into a silent killer category independent of cirrhosis. The present modifications in food habits, drug induced toxicity and other environmental toxicity has led to a dramatic rise in HCC even in non-alcoholics. The symptoms and pathogenesis in HCC can be eventually be correlated with Garavisa Lakshana, Samprapthi and the judicious application of its treatment in Ayurveda can concrete a new path in its treatment aspect.

Keywords: Toxicity induced HCC, Gara visha.

Chemotherapy—an Ayurveda approach

Role of Visha in Cancer/Use of Prativisha

Chemotherapy can be defined as the treatment of disease by the use of chemical substances, especially the treatment of cancer by cytotoxic and other drugs. Cancer cells tend to grow fast, and chemo drugs kill fast-growing cells. But because these drugs travel throughout the body, they can affect normal, healthy cells that are fast-growing, too. Damage to healthy cells causes side effects. Side effects are not always as bad as you might expect, but many people worry about this part of cancer treatment. Still now there is no option in Ayurveda practice for chemotherapy. On the other hand there is a good scope in management of adverse effects of chemotherapy.

Aim: Main objective of this research work is to re-establish therapies that can replace the chemotherapy and use of Agadatantra in management of adverse effects of chemotherapy.

Materials and Methods: Thorough literature review was done to find out therapies that can replace the chemotherapy in Ayurvedic texts. Correlate adverse effects of chemotherapy with Ayurvedic Visha Lakshana (toxic effect) to adopt effective management was done. Interpretation was done relevantly.

Results: With literature review most relevant therapy found to replace chemotherapy was Prativisha Chikitsa (antidote therapy) described in 48th chapter of Ashtanga Samgraha. In this reference they indicate Visha for management of incurable diseases like cancers. When considering the adverse effects of chemotherapy most of symptoms can be correlate with Garavisha (acute toxicity) and Dushivisha (chronic toxicity). Therefore, treatment of Garavisha and Dushivisha can be used to manage adverse effects of chemotherapy.

Conclusion: Use of Prativisha Chikitsa can replace chemotherapy treatment in cancer management. Garavisha and Dushivisha Chikitsa might be effective in management of adverse effects of chemotherapy.

Keywords: Cancer, chemotherapy, Dushivisha, Prativisha, Garavisha.

4. Ayurveda–Agadatantra and Cancer (for More References)

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9757503/>

5. The Role of Shirisharishta In the Management of Thyroid CA

<http://jyothsnika.blogspot.com/2012/07/scope-of-agadatantra-in-themanagement.html?m=1>

Summary

Toxic Carcinogens

Toxic Carcinogen are toxic substance increases the risk of cancer. Carcinogens are of physical such as ultra violet rays, chemical such as asbestos and biological such as infections caused by certain virus. Experts have identified more than 100 carcinogens. When a body comes in contact with the carcinogens, they are processed or metabolized differently, according to those they are classified into:

1. Direct acting carcinogens
2. Indirect acting geno-toxic carcinogens
3. Co-carcinogens

Toxic Carcinogens

On the exposure develops cancer. This occurs through

- ❖ The environment
- ❖ Specific lifestyle choices
- ❖ Certain medical treatments
- ❖ Some Infection

Toxins Causes' Cancer

1. **Food:** Additives and contaminants.
2. **Tobacco (tamraparni):** Causes cancer in digestive system, respiratory system.
3. **Ethanol:** Liver and oesophageal cancer.
4. **Arsenic exposure:** Causes skin and lung cancer.
5. **Polycyclic hydrocarbon:** Cancer of lungs, skin.
6. **Alkylating agents:** Acute myelocytic leukemia.
7. **Asbestoses:** Lung cancer
8. **Sunlight (UV light):** skin cancer.
9. **Pesticides:** Lungs cancer, skin cancer.
10. **Nitrogen mustard gases:** Cancer of nasal sinuses, lung cancer.

Major chemo-therapy drugs	Main Complication
Taxanes	Causes GIT toxicity like stomatitis, vomiting nausea and diarrhea
Oxaliplatin	Causes gastro-esophageal reflux, constipation, stomatitis, dyspepsia
Anthracyclins	Causes ulceration of esophagus, tongue, anorexia, stomatitis
Cytarabine, Gemcitabine	Oral, anal inflammation or ulceration, bowel necrosis, pancreatitis, hepatic dysfunctions
Methotrexate	Pharyngitis, melena, GIT ulcerations

Ayurveda Approach

All drugs used for chemotherapy and radiotherapy are ushna and tikshna as per Ayurveda. This is the reason for these many complications occurring after the therapy. Also person's bala/body strength (immunity) is poor.

In modern medicine as well in Ayurveda number of references regarding the pathogenesis and management of cancer.

There are **two aspects** of cancer can be consider here as per Ayurveda :

1. Causative agent/carcinogen is making damages or toxicities in the healthy cells.
2. The common treatment usually given for cancer is radiation and chemotherapy, which are already toxic and having so many complications.

These two aspects are very much related with Agadatantra.

The following Agada formulations can be used against side effects of chemo and radio therapy complications due to its properties against ushna teeksshna gunas and vishahara properties.

- ❖ **Padmaka ghrita:** Padmaka swarasa, durva swarasa, anantamoola, ghrita-having vishagna properties.
- ❖ **Vishaghna and Raktaprasadaka drugs:** Like Sariva, manjishta, kakamachi, kakamachi, Ushira.
- ❖ **Vishaghna mahakashaya:** Vishaghna dasaimani, Haridra, Manjishta, Suvaha, Sookshmaila, palindi, Chandana, kataka, sirisha, Sindhuvara, Shleshmataka.

Agada and Visha Dravya prayoga in the prevention of Cancer

- ❖ **Arka:** Possesses anticancer activity against pancreatic cancer. Also having anti-tumor activities.
- ❖ **Snuhi :** Anticancer activity against renal carcinogenicity.
- ❖ **Bhanga:** Effective against prostate cancer.
- ❖ **Bhallataka:** Anticancer property against liver cancer, breast cancer, laryngo-pharyngeal activity.
- ❖ **Arsenic trioxide:** Effective against acute Promyelocytic leukemia.

Important Questions MCQ

1. Carcinogens are classified as based on their metabolism into
 - a. 1
 - b. 2
 - c. 3
 - d. 4
2. Aflatoxin is an example of
 - a. Physical carcinogen
 - b. Chemical carcinogen
 - c. Biological carcinogen
 - d. Co-carcinogen
3. Infections are the examples of
 - a. Physical carcinogen
 - b. Chemical carcinogen
 - c. Biological carcinogen
 - d. Co-carcinogen

Answer key

1. c 2. b 3. c

Learning Objectives

- Describe the scope of oncology in Ayurveda, describe the toxic carcinogens, complications of radiation and chemotherapy and its Ayurvedic approach of management.
- Explain the role of visha, vishaghna dravyas in the management of cancer with research updates.

Important SAQ

- What are carcinogens, briefly describe toxic carcinogens,
- Explain types of carcinogens.
- What are the toxicities occurred due to radiation therapy?
- What are the toxicities occurred due to chemotherapy?
- Discuss application Agadatantra in the management of cancer.

Forensic Medicine (Vyavahara Ayurveda) and Medical Jurisprudence (Vidhi Vaidyaka)

15.1 Forensic Medicine and Medical Jurisprudence

Forensic Medicine

It is the application of medical knowledge and paramedical knowledge for the administration of justice. It is a multi-disciplinary branch which includes the practice of forensic pathology, forensic psychiatry, forensic dentistry, forensic radiology and forensic toxicology. It is also explained as a group of medical specialties which deals with the examination and diagnosis of individuals who have been injured by or who have died due to external or unnatural causes such as poisoning, assault, suicide and other forms of violence and apply findings to law.

A doctor acquires medical knowledge during his career and applies that knowledge in giving his opinions in various cases to solve medico-legal problems which are encountering the legal authorities.

There are two main branches of forensic medicine, clinical forensic medicine and pathological forensic medicine. These two differ by the condition of the patients. In clinical forensic medicine, it is the investigation of trauma to living patients. Whereas pathological forensic medicine

involves the examination of traumas to the deceased to find the cause of death.

The word '**forensic**' originated from a Latin word '**of the forum**'. Forum was the meeting place where the legal matters were discussed. This forensic medicine is also called 'Legal medicine'.

Medical Jurisprudence

(*Juris* = law, *prudentia* = knowledge in Latin)

Medical jurisprudence is the subject dealing with the aspect of the law concerning medical practice and knowledge. It mainly deals with the legal aspect of practice of medicine. It is the branch of science and medicine involving the study and application of scientific and medical knowledge to legal problems such as inquest, and in the field of law. It includes responsibilities of the doctor and deals particularly with doctor and patient relationship, medical negligence, rights privileges, duties of a doctor, professional misconduct, consent and medical ethics. It is also called as state medicine.

Vyavahara

- ❖ The factor which makes the person able to have the discrimination power between true and false subjects which in turn enhances the faith of an individual on

Dharma and helps in achieving its goals & visions is called as Vyavahara.

- ❖ According to Acharya Manu (Manusmriti), winning of justice during prosecution in the court is known as Vyavahara.
- ❖ 'Vyavahara Ayurveda' is a coined term to imply the meaning of 'Forensic Medicine'
- ❖ 'Vidhivaidyaka' is a coined term to imply the meaning of 'Medical Jurisprudence'.

History of Vyavahara Ayurveda & Vidhi Vaidyaka

A. Ancient Era

Medicine and law have been related from the earlier times. References are found in the Vedas, Kautilya's Arthashastra, Manusmriti, and also in some Ayurvedic texts like Charaka Samhita & Sushruta Samhita.

- ❖ **Vedas (2000-1000 B.C.):** Rudra & Varuna have implemented the law & order. Descriptions about the laws are there in relation to medicine. Atharvaveda gives details how to cure wounds, poisoning & snake bites.
- ❖ **Kautilyas Arthashastra (300 B.C.):** It mainly explains Danda niti which incorporates laws & disciplines needed in the execution of punishment.
- ❖ **Manusmriti (200 B.C.):** Manu was the first and foremost traditional king who gave disciplined laws to the country. He explained principles of the king, protection of the people, court laws, witness, false witness, false statements, false oath and parameters for punishments for different types of crimes. He also explained some subjects related to Vyavahara Ayurveda such as sexual offences, rape and marital relations.
- ❖ **Samhitas:** Ancient Ayurvedic texts such as Charaka Samhita & Sushruta Samhita have described the ethical & social status,

responsibilities, duties, qualities & skills of a good physician.

B. Modern Era

In 16th-century Europe, medical practitioners in army and university settings began to gather information on the cause and manner of death. Ambroise Paré, a French army surgeon, systematically studied the effects of violent death on internal organs. Two Italian surgeons, Fortunato Fidelis and Paolo Zacchia, laid the foundation of modern pathology by studying changes that occurred in the structure of the body as the result of disease. In the late 18th century, writings on these topics began to appear. The first chair of professor Medical Jurisprudence in India was established in 1857 at Madras Medical College.

The Indian Penal Code (IPC) came into existence in 1860, the Indian Evidence Act in 1872 and the Criminal Procedure Code (CPrC) in 1974.

15.2 Introduction to Indian Penal Code, Indian Evidence Act and Criminal Procedure Code

Indian Penal Code (IPC)

- ❖ Act ID = 186045
 - ❖ Enactment Year = 1860
- IPC is the official criminal code of India. It is a comprehensive code intended to cover all substantive aspects of criminal law. IPC has 23 chapters and comprises 511 sections.

Indian Evidence Act (IEA)

- ❖ Act ID = 18721
- ❖ Enactment Year = 1872

The Indian Evidence Act contains a set of rules governing admissibility of evidence in the Indian courts of law. The enactment and adoption of the Indian Evidence Act

was a path-breaking judicial measure introduced in India, which changed the entire system of concepts pertaining to admissibility of evidences in the Indian courts.

Until then, the rules of evidences were based on the traditional legal systems of different social groups and communities of India and were different for different people depending on caste, community, faith and social position. The Indian Evidence Act introduced a standard set of law applicable to all Indians.

Indian Evidence Act, 1872 has eleven chapters and 167 sections.

Criminal Procedure Code (CrPC)

❖ Act ID = 19742

❖ Enactment Year = 1973

CrPC is the main legislation on procedure for administration of substantive criminal law in India. It was enacted in 1973 and came into force on 1 April 1974. It provides the machinery for the investigation of crime, apprehension of suspected criminals, collection of evidence, determination of guilt or innocence of the accused person and the determination of punishment of the guilty.

CrPC has 37 chapters and 484 sections, 2 schedules and 56 forms.

❖ **Section 53:** Examination of accused by medical practitioner at the request of police officer.

- When a person is arrested on a charge of committing an offence of such a nature and alleged to have been committed under such circumstances that there are reasonable grounds for believing that an examination of his person will afford evidence as to

the commission of an offence, it shall be lawful for a registered medical practitioner, acting at the request of a police officer not below the rank of sub-inspector, and for any person acting in good faith in his aid and under his direction, to make such an examination of the person arrested as is reasonable necessary in order to ascertain the facts which may afford such evidence, and to use such force as is reasonably necessary for that purpose.

- Whenever the person of a female is to be examined under this section, the examination shall be made only by, or under the supervision of, a female registered medical practitioner.

❖ **Section 53A:** Examination of person accused of rape by medical practitioner. When a person is arrested on a charge of committing an offence of rape or an attempt to commit rape and there are reasonable grounds for believing that an examination of his person will afford evidence as to the commission of such offence, it shall be lawful for a registered medical practitioner employed in a hospital run by the Government or by a local authority and in the absence of such a practitioner within the radius of sixteen kilometers from the place where the offence has been committed by any other registered medical practitioner, acting at the request of a police officer not below the rank of a sub-inspector, and for any person acting in good faith in his aid and under his direction, to make such an examination of the arrested person and to use such force as is reasonably necessary for that purpose.

Highlights of bills replacing IPC, IEA and CrPC-2023

- ❖ The law that replaced the IPC is known as the Bharatiya Nyaya Sanhita 2023 (BNS).

- ❖ The law that replaced CrPC is known as Bharatiya Nagarika Suraksha Sanhita 2023 (BNSS)
- ❖ The law that replaced IEA is known as Bharatiya Sakshya Adhiniyam 2023.

Summary

Forensic Medicine

It is the application of medical knowledge and paramedical knowledge for the administration of justice.

Medical Jurisprudence

Medical jurisprudence is the subject dealing with the aspect of the law concerning medical practice and knowledge. It mainly deals with the legal aspect of practice of medicine.

Indian Penal Code (IPC)

- ❖ Act ID = 186045
- ❖ Enactment Year = 1860

IPC is the official criminal code of India. It is a comprehensive code intended to cover all substantive aspects of criminal law.

IPC has 23 chapters and comprises 511 sections.

Indian Evidence Act (IEA)

- ❖ Act ID = 18721
- ❖ Enactment Year = 1872

The Indian Evidence Act contains a set of rules governing admissibility of evidence in the Indian courts of law.

Criminal Procedure Code (CrPC)

- ❖ Act ID = 19742
- ❖ Enactment Year = 1973

CrPC is the main legislation on procedure for administration of substantive criminal law in India. It was enacted in 1973 and came into force on 1 April, 1974.

CrPC has 37 chapter and 484 sections, 2 schedules and 56 forms.

Highlights of Laws replacing IPC, IEA and CrPC-2023

- ❖ The law that replaced the IPC is known as the Bharatiya Nyaya Sanhita 2023 (BNS).
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- ❖ The law that replaced IEA is known as Bharatiya Sakshya Adhiniyam 2023.

Important Questions

MCQ

1. Application of medical knowledge in the administration of justice
 - a. Forensic medicine
 - b. Toxicology
 - c. Medical Jurisprudence
 - d. Trichology
2. Application of law concerning medical practice & knowledge
 - a. Forensic medicine
 - b. Toxicology
 - c. Medical Jurisprudence
 - d. Trichology

3. IPC is replaced by the name

- a. Bharatiya Nyaya Sanhita 2023 (BNS).
- b. Bharatiya Sakshya Bill 2023
- c. Bharatiya Nagarika Suraksha Sanhita 2023 (BNSS)
- d. Criminal Procedure Act

4. IPC was actually enacted in the year

- a. 1960
- b. 1860
- c. 1973
- d. 1883

5. IPC contains --- sections

- a. 511
- b. 510
- c. 23
- d. 500

Answer Key

1. a

2. c

3. a

4. b

5. a

Learning Objectives

- Define Forensic Medicine and Medical Jurisprudence.
- Describe Indian Penal Code (IPC), Criminal Procedure Code (CrPC) & Indian Evidence Act (IEA).

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Vaidya Sadvritta: Duties and Responsibilities of Medical Practitioner

16.1 Vaidya Sadvritta, Medical Ethics and Code of Conduct, Charaka Oath and Hippocratic Oath

Types and Qualities of Vaidya

1. Trividha Bhishaja
2. Vaidya
3. Raja Vaidya
4. Pranabhisara and Rogabhisara Vaidya
5. Apujya Vaidya

1. Trividha Bhishaja

त्रिविध भिषक्

त्रिविधा भिषजा इति-

भिषक्छद्मचराः सन्ति सन्त्येके सिद्धसाधिताः ।

सन्ति वैद्यगुणैर्युक्तास्त्रिविधा भिषजो भुवि ॥

वैद्यभाण्डौषधैः पुस्तैः पल्लवैरवलोकनैः ।

लभन्ते ये भिषक्शब्दमज्ञास्ते प्रतिरूपकाः ॥

श्रीयशोज्ञानसिद्धानां व्यपदेशादतद्विधाः ।

वैद्यशब्दं लभन्ते ये ज्ञेयास्ते सिद्धसाधिताः ॥

प्रयोगज्ञानविज्ञानसिद्धिसिद्धाः सुखप्रदाः ।

जीविताभिसरास्ते स्युर्वैद्यत्वं तेष्ववस्थितम् ॥

(Ch. Su. 11/50-53)

1. Bhishak Chadmachara / Bhishaka Veshachara

वैद्यभाण्डौषधैः पुस्तैः पल्लवैरवलोकनैः ।

लभन्ते ये भिषक्शब्दमज्ञास्ते प्रतिरूपकाः ॥

(Ch. Su. 11/51)

They pose themselves as doctors by exhibiting a few books, medicines, fresh

leaves in a box, etc. These persons are devoid of knowledge.

2. Siddha Sadhita

श्रीयशोज्ञानसिद्धानां व्यपदेशादतद्विधाः ।

वैद्यशब्दं लभन्ते ये ज्ञेयास्ते सिद्धसाधिताः ॥

(Ch. Su. 11/52)

Those who get the names of famous Vaidya, and boast about their relations with accomplished physicians having wealth, fame and knowledge are ignorant and feigned physicians.

3. Vaidya Guna Yukta

प्रयोगज्ञानविज्ञानसिद्धिसिद्धाः सुखप्रदाः ।

जीविताभिसरास्ते स्युर्वैद्यत्वं तेष्ववस्थितमिति ।

(Ch. Su. 11/53)

Those who are endowed with practical knowledge, scriptural knowledge, accomplished in the administration of therapies, insight and knowledge of therapeutics, are endowed with infallible success and can bring happiness to the patient; they are Jivitabhisarah – saviours of life.

2. Vaidya

According to Ashtanga Hridaya

दक्षस्तीर्थार्त्तशास्त्रोर्थो दृष्टकर्मा शुचिर्भिषक् ।

(A.H.Su. 1/28)

A Physician should be

- ❖ दक्षः – Wise, clever, efficient, skilled, alert, honest.
- ❖ तीर्थार्थशास्त्राः – Knowledgeable about the Shastras.
- ❖ दृष्टकर्मः – Experienced in practical application.
- ❖ शुचिः – Pure in body and mind.

According to Charaka Samhita:

औषधीनां परां प्राप्तिं कश्चिद्वेदितुमर्हति ॥
योगवित्त्वप्यरूपज्ञस्तासां तत्त्वविदुच्यते ।
किं पुनर्यो विजानीयाधौषधीः सर्वथा भिषक्
योगमासां तु यो विद्यादेशकालोपपादितम् ।
पुरुषं पुरुषं वीक्ष्य स ज्ञेयो भिषगुत्तमः ॥

(Cha.Su. 1/121-123)

A physician even ignorant of the form (or names) can be said to be the knower of the essence (of science), if he is acquainted with the principles governing the correct application of drugs, let alone the one who knows drugs in their entirety. One who knows the principles governing their correct application in consonance with the place, time and individual variation should be regarded as the best physician.

स्मृतिमान् हेतुयुक्तिज्ञो जितात्मा प्रतिपत्तिमान् ।

भिषगौषधसंयोगैश्चिकित्सां कर्तुमर्हति ॥

(Cha.Su. 2/36)

The physician who is endowed with memory, having adequate knowledge of causes (of diseases and health) and principles of propriety, self-restrained and having presence of mind is entitled to practice medicine through the combination of various drugs.

Qualities of Physician

श्रुते पर्यवदातत्वं बहुशो दृष्टकर्मता ।
दाक्ष्यं शौचमिति ज्ञेयं वैद्ये गुणचतुष्टयम् ॥

(Cha.Su. 9/6)

Qualities of Vaidya

- ❖ Excellent medical knowledge.
- ❖ Extensive practical knowledge and experience.
- ❖ Dexterity, wisdom, cleverness.
- ❖ Cleanliness.

Six Qualities of Physician

विद्या वितर्को विज्ञानं स्मृतिस्तत्परता क्रिया ।

यस्यैते षड्गुणस्तस्य न साध्यमतिवर्तते ॥ (Cha. Su.9/21)

Six qualities of Vaidya

1. Knowledge of Ayurveda
2. Analytical mind
3. Proper understanding, special knowledge
4. Good memory
5. Dedication
6. Practical experience

विद्या मतिः कर्मदृष्टिरभ्यासः सिद्धिराश्रयः ।

वैद्यशब्दाभिनिष्पत्तावलमेकैकमप्यतः ॥

यस्य त्वेते गुणाः सर्वे सन्ति विद्यादयः शुभाः ।

(Cha.Su. 9/22)

Vidya (Knowledge of Ayurveda), Mati (wisdom), Karma Drishti Abhyasa (practical experience), Siddhi (expertise), Ashraya (guidance from expert teacher); these words explain the qualities of Vaidya. The one who combines all these good qualities will distribute happiness and comfort to all living beings.

तत्रेमे भिषगगुणा यैरुपपन्नो भिषग्धातुसाम्याभिनिर्वर्तने
समर्थो भवति; तद्यथा—पर्यवदातश्रुतता, परिदृष्टकर्मता,
दाक्ष्यं, शौचं, जितहस्तता, उपकरणवत्ता, सर्वेन्द्रियोप-
पन्नता, प्रकृतिज्ञता, प्रतिपत्तिज्ञता चेति ।

(Cha.Vi. 8/86)

❖ Qualities of a physician:—

- ❖ Excellent and pure knowledge of scriptures.
- ❖ Practical experience.

- ❖ Observation and individual performance of treatments.
- ❖ Skill, dexterity
- ❖ Purity, cleanliness
- ❖ Possessing all the required equipment.
- ❖ Excellence of all sense organs
- ❖ Knowledge about Prakriti
- ❖ Knowledge about the course of action.

3. Raja Vaidya

हेतौ लिङ्गेः प्रशमने रोगाणामपुनर्भवे ।

ज्ञानं चतुर्विधं यस्य स राजार्हो भिषक्तमः ॥

(Cha.Su.9/19)

One who possesses the knowledge of the below four factors is fit to become a Raja Vaidya (Royal Physician):

- ❖ **Hetu:** Causative factors for diseases.
- ❖ **Linga:** Characteristic features of diseases.
- ❖ **Prashamana:** Treatment methods for diseases.
- ❖ **Rogaanaam Apunarbhava:** Preventive methods for diseases.

4. Pranabhisara and Rogabhisara Vaidya

Pranabhisara: Who saves lives and kills diseases.

Rogabhisara: Who worsens diseases and kills life.

तस्माच्छस्त्रेऽर्थविज्ञाने प्रवृत्तौ कर्मदर्शने ।

भिषक् चतुष्टये युक्तः प्राणाभिसर उच्यते ॥

(Cha.Su. 9/18)

A physician devoted and deeply engaged to the following four factors is known as Pranabhisara Vaidya.

- ❖ **Shashtra:** Knowledge in scientific scriptures
- ❖ **Artha vignana:** Meaning of the true sense of scriptures
- ❖ **Pravritti:** Practical knowledge / application
- ❖ **Karma Darshana:** Practical experience

कुलीना पर्यवदातश्रुताः परिदृष्टकर्माणो दक्षाः शुचयो
जितहस्ता जितात्मनः सर्वोपकरणवन्तः सर्वेन्द्रियोपपन्नाः
प्रकृतिज्ञाः प्रतिपत्तिज्ञाश्च ते ज्ञेयाः प्राणानामभिसारा
हन्तारो रोगाणां; तथाविधा हि केवले शरीरज्ञाने शरीरा-
भिनिर्वृतिज्ञाने प्रकृतिविकारज्ञाने च निसंशयाः, सुखसा-
ध्यकृच्छ्रसाध्ययाप्यप्रत्याख्येयानां च रोगाणां समुत्थान-
पूर्वरूपलिङ्गवेदनोपशयविशेषज्ञाने व्यपगतसंदेहाः ॥

(Cha.Su. 29/6)

Born in a noble family, well versed in science, practical experience, skillful, clever, wise, pure in body and mind, control over mind, healthy sense organs - Knowledge about Rachana and Kriya Sharira, Prakriti and Vikriti. Knowledge about Trividha Ayurveda Sutra (3 principles of Ayurveda) (a) Hetu; (b) Linga; (c) Prashamana - Knowledge about Trividha Aushadha Grama (3 sources of medicines) (a) Jangama; (b) Parthiva; (c) Sthavara - He should be an expert on various subjects such as: Chatur-sneha, Pancha-lavana, Asthamutra, Astha-kshira, Shirovirechanadi Panchakarmashraya Aushadha, Bhojana, Pana, Nyama, Sthana, Chankramana, Shayana, Asana, Matra, Dravya, Anjana, Dhuma, Navana, Abhyanga, Parimarjana, Vega Vidharana, Vyayama, Satmya, Indriya Pariksha Upakrama, Sadvritta, Vyadhi, Dasha Pranayatana, etc.

Rogabhisara Vaidya

अतो विपरीता रोगाणामभिसरा हन्तारः प्राणानां
भिषक्छद्मप्रतिच्छन्नाः कण्टकभूता लोकस्य प्रतिः
पकस्थर्माणो राज्ञां प्रमादाच्चरन्ति राष्ट्राणि ।

(Cha.Su. 29/6)

Opposite to Pranabhisara — Moves about to search for patients :

- ❖ Tries to find faults in other physicians.
- ❖ Wins over friends of the patients by pleasing them.
- ❖ Tries to cover his ignorance.

- ❖ If disease does not get alleviated, blames the patient for lack of proper equipment, attendance and self-control, etc.

5. Apujya Vaidya

Apujya Vaidya is the type of physician who should not be praised, followed or asked for consultation due to improper qualities such as lack of knowledge, ignorance, wrong intentions, etc.

यदृच्छ्या समापन्नमुत्तार्य नियतायुषम्।

भिषङ्मानि निहन्त्याशु शतान्यनियतायुषाम्॥

(Cha.Su.9/17)

Bhishangmani (one regarding himself as a physician) cures by chance a diseased person whose life span is certain, but on the other hand, kills hundreds having an uncertain life span.

Chaturvidha Vaidyavritti

मैत्री कारुण्यमार्तेषु शक्ये प्रीतिरुपेक्षणम्।

प्रकृतिस्थेषु भूतेषु वैद्यवृत्तिश्चतुर्विधेति॥

(Cha.Su.9/26)

The 4 disciplines a Vaidya should follow are:

- ❖ **Maitri:** Equality/Friendliness.
- ❖ **Arteshu Karunyam:** Sympathy and kindness towards the patients.
- ❖ **Shakye Pritih:** Focus on curable diseases.
- ❖ **Upekshanam Prakritithshu:** Neglect of incurable disease

Vaidya Sadvrittam

Refer to:

- ❖ Astanga Hridaya, Sutra Sthana, Adhyaya 2/21-48.
- ❖ Charaka Samhita, Sutra Sthana, Adhyaya 8/18-29.
- ❖ Charaka Samhita, Vimana Sthana, Adhyaya 8/13.
- ❖ Charaka Samhita, Chikitsa Sthana, Adhyaya 1:4/30-33.

- ❖ Sushruta Samhita, Sutra Sthana, Adhyaya 2/6.
- ❖ Sushruta Samhita, Sutra Sthana, Adhyaya 10/3.
- ❖ Sushruta Samhita, Sutra Sthana, Adhyaya 10/9.
- ❖ Chaturvidha Vaidyavritti.

Ethics

Ethics are defined as a set of moral principles or values.

Etiquette: Etiquette is defined as the conduct or procedure required or prescribed by authority to be observed in official life.

Ethics	Etiquette
Ethics refer to the moral principles that govern our behaviour	Etiquette is a set of rules indicating the proper and polite way to behave
Ethics related to principles	Etiquette is related to behaviour

Basic Principles of Medical ethics

- 1. Patient autonomy:** It is the right of the patient to make decisions about his medical care. A patient has the ultimate decision making responsibility for his own treatment. A medical practitioner cannot impose treatment on a patient. A doctor can suggest the positives of a particular treatment to a patient but he cannot impose such treatment to the patient. This autonomy is important because we need to make sure that the patient is actively involved in his diagnosis and treatment.
- 2. Beneficence:** It is doing what is in the best interest of the patient throughout the process of diagnosis and treatment. A physician intent to beneficence conflicts most often with patient autonomy. When disagreement arises between healthcare provider and the patient, the healthcare provider must explain the reasons for his

recommendations, allowing the patient to make a more informed decision.

3. **Non-maleficence (Do not harm):**

Complementary to beneficence, Non-maleficence ensures the patient that no harm will happen (physically, mentally, or otherwise) after the treatment than before.

4. **Confidentiality:** The patient trusts that the physician will not disclose to others about the particulars of his illness.

WMA International Code of Medical Ethics

The Code of Medical Ethics formulated by the World Medical Association (WMA) brings together the essential points that everyone should be aware of, in a concise, easily understood fashion, under three heading: Duties of Physicians in General; Duties of Physicians to Patients; Duties of Physicians to Colleagues.

'Physician' in this context refers to all medical practitioners, irrespective of their specialty or seniority.

Duties of Physicians in General

- ❖ **A Physician shall** always exercise his/her independent professional judgment and maintain the highest standards of professional conduct.
- ❖ **A Physician shall** respect a competent patient's right to accept or refuse treatment.
- ❖ **A Physician shall** not allow his/her judgment to be influenced by personal profit or unfair discrimination.
- ❖ **A Physician shall** be dedicated to providing competent medical service in full professional and moral independence, with compassion and respect for human dignity.
- ❖ **A Physician shall** deal honestly with patients and colleagues, and report to

the appropriate authorities about those physicians who practice unethically or incompetently or who engage in fraud or deception.

- ❖ **A Physician shall** not receive any financial benefits or other incentives solely for referring patients or prescribing specific products.
- ❖ **A Physician shall** respect the rights and preferences of patients, colleagues, and other health professionals.
- ❖ **A Physician shall** recognise his/her important role in educating the public but should use due caution in divulging discoveries or new techniques or treatment through non-professional channels.
- ❖ **A Physician shall** certify only that which he/she has personally verified.
- ❖ **A Physician shall** strive to use health care resources in the best way to benefit patients and their community.
- ❖ **A Physician shall** seek appropriate care and attention if he/she suffers from mental or physical illness.
- ❖ **A Physician shall** respect the local and national codes of ethics.

Duties of Physicians to Patients

- ❖ **A Physician shall** always bear in mind the obligation to respect human life.
- ❖ **A Physician shall** act in the patient's best interest when providing medical care.
- ❖ **A Physician shall** owe his/her patients complete loyalty and all the scientific resources available to him/her. Whenever an examination or treatment is beyond the physician's capacity, he/she should consult with or refer to another physician who has the necessary ability.
- ❖ **A Physician shall** respect a patient's right to confidentiality. It is ethical to disclose confidential information when the patient

consents to it or when there is a real and imminent threat of harm to the patient or to others and this threat can be only removed by a breach of confidentiality

- ❖ **A Physician shall** give emergency care as a humanitarian duty unless he/she is assured that others are willing and able to give such care.
- ❖ **A Physician shall** in situations when he/she is acting for a third party, ensure that the patient has full knowledge of that situation.
- ❖ **A Physician shall** not enter into a sexual relationship with his/her current patient or into any other abusive or exploitative relationship.

Duties of Physicians to Colleagues

- ❖ **A Physician shall** behave towards colleagues as he/she would have them behave towards him/her.
- ❖ **A Physician shall NOT** undermine the patient-physician relationship of colleagues in order to attract patients.
- ❖ **A Physician shall** when medically necessary, communicate with colleagues who are involved in the care of the same patient. This communication should respect patient confidentiality and be confined to necessary information.

Code of Conduct

It is the content or part of the text book Charaka Samhita Ayurveda text. The content in the passage is considered as Charaka Sapatha is written in the form of a set of instructions by a teacher to prospective students of science of medicine. According to Charaka Samhita the unconditional agreement to abide by these instructions is a necessary precondition to be eligible to be taught in the science of medicine. This gives explicit instructions on the necessity

of practicing asceticism during student life, student teacher relationship, the importance of committing oneself fully and completely for the wellbeing of the patient, whom to treat, how to behave with women, and several other related issues. This is taken from paragraph number 13-14 of Charaka Samhita Vimana sthana.

Charaka's oath of initiation /Charaka Shapatha

The teacher should instruct the disciple in the presence of the sacred fire, Brahmanas and Vaidyas:

- ❖ "Thou shalt speak only the truth, . . . be free from envy... There shall be nothing that thou oughtest not to do at my behest except hating the king or causing another's death or committing an act of unrighteousness or acts leading to calamity."
- ❖ "Thou shalt behave and act without arrogance and with undistracted mind, humility and constant reflection..."
- ❖ "Thou shalt pray for the welfare of all creatures..."
- ❖ "Day and night however thou mayest be engaged, thou shalt endeavour for the relief of patients with all thy heart and soul. Thou shalt not desert or injure thy patient even for the sake of thy life..."
- ❖ "Thou shalt not commit adultery even in thought. Even so, thou shalt not covet others' possessions... Thou shouldst speak words that are gentle, pure and righteous, pleasing, worthy, true, wholesome and moderate. Thy behaviour must be in consideration of time and place and heedful of past experience. Thou shalt act always with a view to the acquisition of knowledge and the fullness of equipment..."
- ❖ "When entering the patient's house, thou shalt be accompanied by a man known to

the patient and who has his permission to enter. Thou shalt be well clad and bent of head, self-possessed and conduct thyself after repeated consideration... Having entered, thy speech, mind, intellect and senses shall be entirely devoted to no other thought than that of being helpful to the patient and of things concerning him only."

- ❖ "The peculiar customs of the patient's household shall not be made public. Even knowing that the patient's span of life has come to its close, it shall not be mentioned by thee there, where if so done, it would cause shock to the patient or to others. "Though possessed of knowledge, one should not boast..."

(Charaka Samhita Vol. I, Shree Gulabkunverba Ayurvedic Society, Jamnagar, 1949. Pages 163-164)

Brief Transliteration of Maharshi Charaka Shapatha

- ❖ During the period of study I shall live a disciplined life with my teachers and peers. My action shall be guarded, service oriented and free from indiscipline and envy. In my dealings, I shall be patient, obedient, humble, constantly contemplative and calm. I shall aim my full efforts and ability towards the desired goal of my profession.
- ❖ As a physician, I shall always use my knowledge for welfare of mankind.
- ❖ I shall always be ready to serve patients, even if I am extremely busy and tired. I shall not harm any patient for the sake of monetary or selfish gains, nor selfish gains, nor shall I entertain a desire for lust, greed or wealth. Immorality shall not emerge even in my thoughts.
- ❖ My dressing shall be decent yet impressive and inspiring confidence. my conduct shall always be appropriate, pleasant,

truthful, beneficial and polite. I shall use my experience in actions appropriate for that time and place.

- ❖ I shall constantly endeavour to accomplish/keep updated with the latest developments in the field and widen my knowledge.
- ❖ I shall treat patient of gender other than mine in presence of relatives or attendants.
- ❖ When examining a patient, my discretion, attention and senses shall be concentrated on the cure of the disease. I shall not divulge the confidentiality related to the patient or family inappropriately.
- ❖ Although an authority (in my subject), I shall not display my knowledge and skill with arrogance.

Hippocrates Oath

About The Oath

The Hippocratic Oath is traditionally administered to the young physician (modern) upon entering the profession. Although usually attributed to Hippocrates, it is probably an ancient Roman oath.

Hippocrates, the Greek physician called the Father of Medicine, lived from about 460 B.C. to 377 B.C. He placed medicine on a scientific foundation, freeing it from superstition, philosophy and religious rites, gave sound and shrewd descriptions of many diseases and raised the ethical standards of medical practice. His physiology, pathology and therapeutics were based largely on the doctrines of his predecessors.

Oath

- ❖ By all that I hold highest, I promise my patients competence, integrity, candor, personal commitment to their best interest,

compassion, and absolute discretion, and confidentiality within the law.

- ❖ I shall do by my patients as I would be done by; shall obtain consultation whenever I or they desire; shall include them to the extent they wish in all important decisions; and shall minimise suffering whenever a cure cannot be obtained, understanding that a dignified death is an important goal in everyone's life.
- ❖ I shall try to establish a friendly relationship with my patients and shall accept each one in a nonjudgmental manner, appreciating the validity and worth of different value systems and according to each person a full measure of human dignity.
- ❖ I shall charge only for my professional services and shall not profit financially in any other way as a result of the advice and care I render my patients.
- ❖ I shall provide advice and encouragement for my patients in their efforts to sustain their own health.
- ❖ I shall work with my profession to improve the quality of medical care and to improve the public health, but I shall not let any lesser public or professional consideration interfere with my primary commitment to provide the best and most appropriate care available to each of my patients.
- ❖ To the extent that I live by these precepts, I shall be a worthy physician.

Declaration of Geneva

It is the one of the World Medical Association's (WMA) oldest policies adopted by the 2nd General assembly in Geneva 1948. It builds on the principles of the Hippocratic Oath and is now known as its modern version. It also remains one of the most consistent documents of the WMA.

It is the medical code of ethics that highlighted the humanitarian character of the physician's profession and the field of medicine.

This specifies mainly the principles of beneficence and non-maleficence and the rules of confidentiality.

The Hippocratic Oath has 4 parts

A pledge to pagan deities, a list of positive obligations, a list of negative obligations and a concluding piety. Each section has ethical implications.

16.2 NCISM - Constitution, Objectives and Functions

About National Commission for Indian System of Medicine

The National Commission for Indian System of Medicine was formed in 2020 by the Government of India as statutory board by passing The National Commission for Indian System of Medicine (NCISM) Bill. The bill was passed in the Lok Sabha in August 2021, and replaced Indian Medicine Central Council Act, 1970.

The National Commission for Indian System of Medicine set up according to the National Commission for Indian System of Medicine Act, 2021, governs the Board of Ayurveda and Unani and the Board of Unani, Siddha and Sowa Rigpa.

Constitution of the Organisation

- ❖ National Commission for Indian System of Medicine is made up of **29 members appointed by the Central Government.**
- ❖ The organisation has two boards, one for assessing and granting educational institution permission for Indian Systems of Medicine, and the other for ethics and registration of practitioners of Indian systems of medicine.

❖ Members of NCISM includes

- A chairperson
- the president of board of Ayurveda
- the president of board of Unani, Siddha, and Sowa-Rigpa
- the president of the medical assessment and Rating board for Indian System of Medicine
- advisor or joint Secretary in charge of Ayurveda, ministry of AYUSH and
- three members (part time) to be elected by the registered medical practitioners of Ayurveda and one member each by the respective registered medical practitioner of Siddha, Unani and Sowa-Rigpa among themselves from the prescribed regional constituencies under the bill.

❖ Further within three years of the passage of the Bill, state governments will establish State Medical Councils for Indian System of Medicine at the state level.

(The National Commission for Indian System of Medicine is the statutory body constituted under NCISM Act, 2020 vide gazette notification extraordinary part (ii) section 3 (ii) dated 21.09.2020)

- An Act to provide for a medical education system that improves access to quality and affordable medical education.
- Ensures availability of adequate and high quality medical professionals of Indian System of Medicine in all parts of the country.
- That promotes equitable and universal healthcare that encourages community health perspective and makes services of such medical professionals accessible and affordable to all the citizens.
- That promotes national health goals; that encourages such medical profess-

ionals to adopt latest medical research in their work and to contribute to research.

- That has an objective periodic and transparent assessment of medical institutions and facilitates maintenance of a medical register of Indian System of Medicine for India and enforces high ethical standards in all aspects of medical services.
- That is flexible to adapt to the changing needs and has an effective grievance redressal mechanism and for matters connected therewith or incidental thereto.

Functions**Functions of NCISM include**

- ❖ Framing policies for regulating medical institutions and medical professionals in Indian System of Medicine.
- ❖ Assessing the requirements of healthcare related human resources and infrastructure.
- ❖ Ensuring compliance by the State Medical Councils of Indian System of Medicine of the regulations made under the Bill.
- ❖ Ensuring coordination among the autonomous boards set up under the Bill.

Objectives

The Aims and objectives of the National Commission for Indian System of Medicine are to—

- ❖ Improve access to quality and affordable Ayurveda, Unani, Siddha and Sowa-Rigpa (AUS&SR) medical education;
- ❖ Ensure availability of adequate and high quality AUS&SR medical professionals in all parts of the country;
- ❖ Promote equitable and universal healthcare that encourages community

- health perspective and makes services of AUS&SR medical professionals accessible to all the citizens;
- ❖ Encourage medical professionals to adopt latest medical research in their work and to contribute to research;
- ❖ Objectively assess and rate medical institutions periodically in a transparent manner;
- ❖ Maintain a National AUS&SR medical register for India;
- ❖ Enforce high ethical standards in all aspects of AUS&SR medical services;
- ❖ Have an effective grievance redressal mechanism;
- ❖ Provide medical education system that improves access to quality and affordable medical education;
- ❖ To promote national health goals;
- ❖ To encourage such medical professionals to adopt latest medical research in their work and to contribute to research;
- ❖ To carry out Periodic and transparent assessment of medical institutions
- ❖ Regulations as per bill are adhered by State Medical Councils offering courses in Indian System of Medicine;
- ❖ Coordination between autonomous bodies formed under bill.

16.3 Duties, Rights and Privileges of a Registered Medical Practitioner

Duties of a Medical Practitioner

1. A medical practitioner should uphold the dignity and honour of his profession.
2. A doctor should execute the skill and care in connection with his professional practice, i.e. in attending, treating, performing operations doing investigations etc.
3. Doctor should get informed consent from the patient or his relatives after

explaining all procedures and risk before doing surgery.

4. In emergencies doctor should execute his moral and humanitarian duty to save the life of the patient.
5. In medico-legal cases, doctor is duty bound to inform police. In homicidal cases, he should not issue death certificates in suicidal, homicidal and accidental deaths.
He should also arrange for recording dying declaration and if magistrate is not available can record the dying declaration in the presence of two witnesses.
6. Doctor has to issue medical and medico-legal certificates (wound certificates, potency certificates, certificate of drunkenness, postmortem certificate) and is bound to go to court for testifying.
7. A physician should keep the medical records of his indoor patients for a period of 10 years.
8. The doctor should keep professional secrecy.
9. Doctor should issue medical records within 72 hours, when requested by the patient or legal authorities.
10. He should maintain a register of medical certificates issued.
11. Keeping of medical and medico-legal records.

Rights and Privileges of Medical Practitioner

1. Right to choose patient.
2. Right to use title and descriptions of his qualification.
3. Right to get appointment in Government and private sectors.
4. Right to practice medicine anywhere in India.
5. Right to issue medical certificates and reports.

6. Right to get reasonable fees for the professional services.
7. Right to prescribe dangerous drugs.
8. Right to give evidence in the court of law.
9. Authorised to conduct medico-legal examinations and autopsy.
10. Entitled to remove eyes from the dead for the purpose of transplantation.

16.4 Consent, Professional Secrecy and Privileged Communication

Consent

Consent is a free and voluntary agreement, approval or permission for compliance of some act. It is valid only when given after knowing the nature and consequence of the consent and fact for which the consent is given.

Consent types

Implied consent (does not need to ask the patients)

When a patient comes to a doctor for medical examination and treatment, the consent is implied. So there is no need of a separate written or oral consent for physical examination of the patient.

It covers general physical examination, inspection, palpation, percussion and auscultation.

It does not cover

- ❖ Examination of private parts
- ❖ Venipuncture (taking blood from a vein by syringe and needle)
- ❖ Injection
- ❖ Major diagnostic and therapeutic procedures like surgery

Expressed consent:

In this, the consent is expressed. It is of 2 types: **Written and Oral**. Any medical procedure beyond routine general physical examination, requires expressed consent.

Oral expressed consent

- ❖ It is taken for the majority of relatively minor examinations (e.g. rectal examinations of male patient by male doctor and female patient by a female doctor) or therapeutic procedure (insertion of IUD in a female patient).
- ❖ It should be preferably obtained in the presence of disinterested third party like nurse.

Written consent

- ❖ It is taken to perform all major diagnostic procedures and general anesthesia.
- ❖ Consent should be taken: (1) in writing because some procedures are very risky and the doctor takes consent in writings as a precaution; (2) in patients own language so that he can understand it well; (3) in presence of witness, signature of both patient as well as witness have to be taken and at last doctor should sign.
- ❖ Written consent should be informed consent.

Informed consent – (Rule of full disclosure):

Consent is given after understanding the result, nature and quality of all the possible risks involved in a procedure. The doctor at the time of obtaining the consent informs or explains the patient each and everything regarding the procedure or the treatment (e.g. illness, prognosis, treatments available, other alternative methods, complications and side effects etc.). It is known as full disclosure. This is done because the patient has to take a knowledgeable and informed decision.

Legal side

According to **IPC 87 and 88**, a person above 18 years can give consent to suffer any harm done in good faith. According to

IPC-89, a child below 12 years or an insane person cannot give valid consent to suffer any harm which may result from an act which is done in good faith. Consent from parents/guardian should be taken to do major surgical procedures if he is below 18 years.

Exceptions of informed consent: In some cases doctor is justified even if all the matters were not fully explained to the patient or didn't get the consent from the patient :

1. Therapeutic privilege
2. Emergency doctrine
3. Therapeutic waiver
4. Loco parentis

1. Therapeutic privilege

It is the privilege of the doctor to withhold from the patient certain information, if the disclosure would cause serious psychological threat to the patient, e.g. malignancy in this matter it has to be informed to the relatives and written consent should be obtained from them before doing any surgery or other invasive procedures on the patient.

2. Emergency doctrine

In an emergency, doctor can do surgery on an unconscious patient without consent and the doctor is protected by Sec. IPC 92. In an emergency when no guardian or parents are available to give consent, doctor can do an emergency surgery if it is necessary to save the life of the patient.

3. Therapeutic waiver

In an emergency situation, the competent person to give consent may give up his right by waiving it. Even if he is not giving the consent the doctor is justified in doing an emergency life saving procedure or surgery on the patient.

4. Loco parentis – in place of parents

In an emergency involving children, when their parents or guardian are not available, consent can be taken from the person who is in charge of the child. E.g. teacher or principal of the residential school. They can give consent in place of the parent.

Consent from victim and accused for examination of medico-legal cases

Consent should be taken from the victim and the accused for examining in medico-legal cases.

Examination of accused

- ❖ The person who is charged or arrested for committing a crime and there are reasons for believing that examination of his person will provide evidence of the crime. A registered medical practitioner can examine such person using reasonable force if the examination is requested by a police officer, not below the rank of sub-inspector. In case of female the examination should be done by female medical officer. (CrPC-53)
- ❖ An arrested person at his request and magistrate feels that the request was made not for the purpose of verification or delay or defeating the ends of justice, can be examined by a doctor to detect evidence in his favour. (CrPC-54)

Examination of victim

- ❖ A victim cannot be examined without consent. If a victim is a female below 18 years and also victim of a sexual assault she should be examined only by a female medical practitioner. (POCSO-2012)
- ❖ According to Sec.164 CrPC, the victim of rape if she is above 18 years can be examined by any registered medical practitioner with her consent.

- ❖ If a person is examined under court order then consent is not needed.

Rules of Consent

1. Consent should be free and voluntary, and there should not be any undue influences, fraud and misinterpretation of facts or compulsion.
2. It should be in a proper form suitably drafted for the circumstances.
3. Written consent should be witnessed by another person.
4. Doctor should explain the object of examination and patient should be informed that the findings would be included in the medical report.
5. In case of an inmate in a hostel, if he is below 12 years, consent for physical examination and minor surgeries should be obtained from the warden. If the inmate is above 18 years does not give consent for examination and treatment he can be asked to leave the hostel.
6. Generally except in the case of communicable diseases, the nature of illness of the patient should not reveal to the hostel authorities without his consent.
7. Consent is not a defense in case of professional negligence.
8. For contraceptive sterilisation, artificial insemination the consent of the spouse is not necessary. But if done without consent it is a ground for divorce.
9. In multi stage treatment, consent should be taken for each stage.
10. If a person has given consent for donating his organs (possible after 18 years) after his death, it can be taken only after getting the consent from spouse/next kin. The same is applicable for study purpose.

11. For medico-legal autopsy no consent is needed from the relatives and doctor can take any organs from the dead body for examining and sending for chemical analysis.
12. Mass immunisation program by the govt. no consent is required.
13. Doctor can use a new lifesaving drug with the consent of the patient.
14. For medical termination pregnancy, the consent of the pregnant lady is sufficient if she is above 18 years.
15. Sexual intercourse with a woman below 18 years even with her consent is rape. This is known as Statutory Rape.
16. A person below 18 years/mentally unsound cannot give valid consent for surgical procedures, or examination for medico-legal purpose. Parent or guardian should give consent.

Blanket consent

Getting the consent without without specifying anything or not giving much information. Most of the hospitals are practicing this type of consent. Blanket consent is having questionable legal validity.

Professional Secrecy

The ethics as well as the universal custom of the medical profession protect the secrets of the medical profession protect the secrets of the patient from disclosure. Doctor is obliged to keep as secrets all that he comes to know about his patient during treatment. He has to keep those things confidential.

It is an implied term of contract between the doctor and the patient. Its disclosure without genuine reason amount to professional misconduct. If the disclosure causes some harm to the patient he can sue the doctor for damages.

So doctor should not disclose things without the consent of the patient. For example: A person is suffering from malignancy and he does not want to reveal it since it may affect his profession, doctor cannot reveal it.

Points of importance

1. Doctors should not discuss the illness of the patient with others and even with patients close relatives without the consent of the patient.
2. Even in the case of husband and wife, the facts relating to illness should not reveal to the spouse without the consent of the patient unless it is a communicable disease affecting the spouse.
3. The facts regarding the employee should not be revealed to the employer without the consent of the employee unless it is not essential.
4. Public should not be informed about a person who is suffering from HIV.
5. Any information regarding a dead person found during autopsy, should not be revealed without consent obtained from the close relatives since it may affect the reputation of the family.
6. Govt doctors are also responsible for keeping professional secrecy even though the treatments given are free.
7. In case of artificial insemination the identity of donor and recipient should be kept secret.
8. In case of minor, mentally ill, intoxicated person the relevant information can be revealed to the appropriate person.
9. In case of minor inmate of a hostel, under trial prisoner or a convict prisoner of any age, relevant information can be revealed to the proper authority.

10. In case of a major under trial prisoner, there is no need for the doctor to reveal information regarding his patient unless ordered by court of law.

Privileged Communication

The doctors can reveal certain facts about a patient to protect the interest of the public or state. If the doctor is disclosing the professional secrets for protecting the interest of the community, he is not liable for damages.

The following are some examples :

1. **Veneral diseases:** A person suffering from HIV infection and he is going to marry, in such situation doctor is obliged to disclose it to the authority.
2. **Infectious diseases:** A person staying in a hospital having some infectious/ veneral disease not taking proper treatment then this matter can be informed to the hostel authority to protect the health of other students.
3. **Notifiable diseases:** Doctor have to inform death, birth, communicable diseases, colour blindness, diminished vision and epilepsy to the health authorities.
4. **In patient's interests:** If the patient suffering from melancholia or suicidal tendencies it has to be informed.
5. **Suspect in a crime:** If a doctor comes across a suspect of crime, he should inform the police (IPC 176, CrPC39).
6. **Court of Law:** There is no professional secrecy when the court asked to reveal.
7. **Insurance reports:** When a doctor appointed on the panel of Life Insurance, he should notice the health status of the patient.

16.5 Professional Negligence, Professional Misconduct, and Unethical Practices

Medical Negligence

Definition

It is the failure to execute reasonable degree of skill and care or wilful negligence of a medical practitioner which causes some harm or bodily injury, or death of the patient.

Types of Negligence

1. **Doctor's negligence:** It is of civil negligence and criminal negligence.
2. **Patient's negligence:** Here in this case only the patient is negligent not the doctor.
3. **Contributory negligence:** Patients negligence + doctors negligence = contributory negligence. When negligence of patient simultaneously contributes to doctor's negligence for causing harm, it is called contributory negligence.
4. **Composite negligence:** When a patient suffers injury as result of combined negligence of more than two doctors, it is known as composite negligence.
5. **Corporate negligence:** Negligence from a corporation (hospital) is called corporate negligence. Individual doctor may or may not be liable. E.g. when a hospital uses defective or poorly maintained equipment or drugs or staffs or doesn't have proper facilities, maintained ICU, oxygen cylinders etc.

Negligence mainly by

1. Act of omission
2. Act of commission

Act of omission – Not doing something that a prudent and reasonable man would do.

Act of commission – Doing something a prudent and reasonable man would not do:

It has 4 essential parts to fulfill (Black law dictionary-4Ds)

1. Duty of care
2. Dereliction of duty
3. Damage
4. Direct causation

❖ **Duty of care:** The medical practitioner has a duty to treat the patient with reasonable skill and care. If he is not executing his duty it amounts to negligence. To bring a medical negligence claim against a defendant, the party must have owed you a professional duty of care at the time of alleged wrongdoing.

Duty arises when a person is approaching the doctor for treatment and doctor examines him. The doctor owes him certain duties, duty of executing skill in what is his illness and treatment needed. Breach of those duties which causes bodily injury becomes negligence. Reasonable skill and care means the skill and care that is expected from a man of his caliber at that time. High caliber of an expert or specialist cannot be expected from an ordinary practitioner.

❖ **Dereliction of duty:** It is the failure to fulfill one's duty of care towards patient or it is the deliberate or accidental failure to do what doctor should do as a part of medical profession.

• **Example:** A doctor starts hysterectomy operation on his patient (duty of care present) and ligate ureter by mistake (that means there is dereliction).

❖ **Damage:** After proving the doctor is having duty of care and dereliction, the plaintiff or the person who complains, now has to prove the damage (either physical or mental) due to the breach of duty or negligent action by the doctor.

Unless there is damage due to negligent act of the doctor, the plaintiff cannot claim any compensation from the doctor.

There are two terms '**damage and damages**' (1) the term '**damage**' refers to **death** or **physical injury or disability** suffered by the patient (loss of limb or loss of potency) or **disfigurement** or others for example aggravating the pre-existing conditions prolonging illness. (2) '**damages**' is a legal term which usually refers to provides financial relief to the victim.

❖ **Direct causation:** After proving that there is the existence of 'Duty of care', 'dereliction of duty' and 'damages' now the plaintiff has to prove that there is a dereliction or breach of duty by the doctor should be directly responsible for the damage occurred to the patient without any intervening cause. This is known as proximate cause. Without this proximate cause, the injury has not occurred.

• **Example:** A patient comes to a doctor for the treatment of a deep wound, the doctor sutured the wound and forgot to take TT injection. Later the patient applied cow dung on the wound after reaching home and developed tetanus and died. In this case, the doctor cannot be charged for medical negligence, even though there is duty, dereliction (no TT was given) and damage (death). This is because the damage or the death was not a direct cause of a doctor's dereliction. The death was due to the application of cow dung.

Civil and Criminal Negligence

As per Indian legal system, there is no definition for civil negligence. But **IPC 304A** deals with criminal negligence "Whoever causes death of any person by doing rash

and negligent act not amounting to culpable homicide shall be punished with imprisonment up to 2 years or with fine or both."

In this case, a gross negligence from the doctor's side has to be proved. This type of case is referred to an expert panel constituted by the District Medical Officer, which contains a medico-legal expert member. This medical board examines the case and gives report to the authority. If the medical board finds that the doctor is negligent then a charge of negligence is given against the doctor.

Examples of Criminal Negligence

1. Amputation of wrong limb of a wrong patient.
2. Removing healthy organs instead of diseased one.
3. Leaving instruments, cotton swabs, tubes, sponges after surgery.
4. Performing criminal abortion and the woman dies.
5. Administration of wrong substances in the eye causes loss of vision.
6. A woman dies due to mismanagement of delivery.
7. A patient dies due to gross incompetent administration of anesthetics by the doctor.
8. Doing treatments/surgical procedures under the influence of alcohol:
 - In criminal cases when there is occurrence of death happens the doctor is executed and punished by IPC 304A.
 - If there is no criminal negligence, the case can be referred to consume protection court or redressal to get compensation for the damages.

Differences between Civil Negligence and Criminal Negligence

Civil Negligence	Criminal Negligence
There is no specific and clear violation of law	There may be violation of law
It is compared to a generally accepted standard of professional conduct	Not compared to any accepted standards
Consent is a good defence	Consent is not a good defence
Trial conducted in civil court, consumer court	Trial in criminal court
Strong evidence is sufficient	Guilt should be proved beyond reasonable doubt
Liable to pay damages	Imprisonment fine or both
Contributory negligence is a good defence	Not a defence
Reparable damage	Irreparable damage or death
Suffered party has to file a case	Public prosecutor on behalf of the state
Patient have to prove negligence	Doctor has to prove innocence

Professional Misconduct or Infamous Conduct

It is defined as something done by a medical practitioner, which is disgraceful or dishonorable to the medical profession. It involves abuse of medical profession.

A medical practitioner should follow code of medical ethics in his profession. The medical council gives some examples of professional misconduct but it is not a complete list. Each case is analysed by its own merit.

The commonly added misconducts in the warning notice:

Professional misconducts -6As

1. Advertising
2. Association
3. Adultery
4. Abortion
5. Alcohol
6. Addiction

1. Advertising

- ❖ A medical practitioner should not advertise his own in the media or report cases treated or operated on by him.
- ❖ An institution can give advertisements but the name of the doctor should not appear.
- ❖ The signboard used by the doctor should be in a moderate size (not too big), should

write his name, qualification, or higher degree, specialty or the available timings. The same should content in his prescription paper in addition can add his address, telephone number and register number.

- ❖ The doctor should not appoint agents for canvassing patients, which is called touting.

2. Association

- ❖ A doctor should not associate with unqualified persons in professional matters.
- ❖ He should not run an open medical shop or sale of medicines prescribed by other doctors and surgical appliances.
- ❖ He should not refer patient to get the share of fee (dichotomy or fee splitting).
- ❖ Doctor should not associate with drug companies, or should not promote drugs for commission.
- ❖ Doctors should not associate with labs or other investigation centres to get commission.
- ❖ Doctors should not assist or take assistance from someone who is not having any professional qualification to attend, treat, or to perform treatment

procedures or surgery. This is called Covering.

3. Adultery

- ❖ Doctor should not have sexual relationship with his patients or relatives of patients. He should not have any improper conduct or association with the patient or patient's family.

4. Abortion

- ❖ Doctor should not perform criminal abortion. When a doctor does termination of pregnancy against MTP Act 1971, it becomes criminal offence.

5. Alcohol

- ❖ Doctor should not consult patients or do any clinical procedures under the influence of alcohol. He should not be drunk and behave disorderly so as to interfere with skilled practice of medicine.

6. Addiction

- ❖ Doctor should not be addicted to any substance of abuse as he may come across many drugs mentioned in the dangerous drugs act like morphine, pethidine, tranquilisers. Doctor should not sell drugs of addiction to his patients other than medical indications.

Others

- ❖ Conviction of a practitioner by criminal court, makes the person liable for removal of his name from the medical register.
- ❖ He should not refuse treatment on religious grounds, i.e. sterilisation, birth control, medical termination of pregnancy.
- ❖ Doctor should not use secret formulas or hints for writing a prescription.
- ❖ Doctor should not issue false certificates, and reports of fitness and illness, especially for court purposes.

- ❖ Doctor should not run an open medical stores for the public or he never sell any drugs belonging to Schedule H and Schedule L drugs for the public.
- ❖ A doctor should not conduct In Vitro Fertilisation treatments or artificial insemination without informed consent from a female recipient and her spouse as well as donor and his wife.
- ❖ A practitioner should not use cases or photographs of the patient revealing his identity without the patient's consent for publishing a journal.
- ❖ Clinical research and drug trial should be done as per ICMR guidelines, done only with the informed consent.

16.6 Defences in Medical Negligent Suits

The defences against medical negligence

1. Calculated risk doctrine

- There is an element of risk in all surgical procedures, injury may occur even though reasonable skill and care has been taken. This is a good defence to any doctor.
- For instance, when a patient undergoing heart surgery dies during surgery, it is considered as a case of professional accident because there is a calculated risk of 5-10%.

2. Contributory negligence

- Any unreasonable conduct from the part of the patient, which is combined with doctor's negligence causing injury is called contributory negligence.

This happens due to

- Failure to give the doctor accurate medical history.
- Failure to cooperate with the doctor in carrying out, his proper instructions.

- Leaving the hospital against doctor's advice.
- Refuses to take advised treatment.
- Failure to take further medical assistance.

In case of contributory negligence, doctor cannot escape from the charge of negligence, but it is a good defence for him in such cases so that the damages awarded can be reduced accordingly.

❖ Limitations of contributory negligence

- **Last clear chance of doctrine:** When a patient negligently placed himself in a position of danger and if the doctor has time to discover the danger and correct it he has got a last chance to correct it. If he failed to prevent the damage even after getting the chance, he cannot bring contributory negligence as a defence.
- **Doctrine of avoidable consequences rule:** This has some similarity with last clear chance doctrine. Here a patient unreasonably refuses to get medical attention leading to aggravation of injury, which could have been if timely attended to.

3. Vicarious liability or respondent superior (liability for the act of another)

- As per law, a man may become liable to pay damages for an act of negligence, committed by his servants or agents in the course of their employment or agency. This is called vicarious responsibility or vicarious liability.

4. Corporate negligence: It is the failure of the administrators of the hospital to provide the adequate facilities including doctors. The hospital administrators should provide standard equipment and competent employees. If a damage has occurred as a result of negligent

action, the hospital administration is responsible.

5. Products liability: If the damaged or death has occurred due to faulty, defective, negligently designed medical or surgical instrument or drug, the manufacturer company is responsible for the damage or death. This is called product liability.

6. Medical maloccurrence: Medical science deals with human life. Inevitable accidents may happen even if adequate precautions, care skill are applied. There is always a factor of risk to life when treating a patient. So doctor cannot be blamed for death that occurred if he had executed care and skill while treating the patient and has done everything in his capacity, that needed to be done.

7. Therapeutic misadventure: This is similar to medical maloccurrence, it happens :

- When drugs are given.
- During diagnostic procedure, using dyes, catheters, etc.
- During surgical treatments.

8. Error in judgement: Only because error in the judgment doctor cannot be held negligent, if he has executed skill and care. Each case is taken on its own merit and analysed to see whether the doctor has taken care and skill in doing sufficient investigations and lab tests before treatment.

9. Res indicata: The case against the doctor should be filed within 2 years from the date of alleged negligence. After this stipulated time the case cannot be filed.

10. Res judicata: According to this rule once a case is completed between 2 parties it cannot be tried again. It prevents a party from bringing the same claim or issue to the court multiple times. Res Judicata

promotes finality and certainty in legal proceedings.

11. **Composite negligence:** The damage has occurred to the patient due to the negligence of 2 or more persons, and not from the part of the patient. The compensation should be split between the defendants.

12. **Novus actus interveniens (an unrelated action intervening)**

- This is usually applied to cases of assault and accidental injury.
- It is applicable in a situation where the cause of disability or death passes from the original incident for which the doctor was responsible, to the later negligent action of some other person.
- However, it would be difficult to prove in cases of disability or death, whether it was a result of the original negligent action, or due to the subsequent incident.

13. **Res Ipsa loquitor (the thing speak for itself)**

- It is a situation where the facts of the case themselves are sufficient to justify the conclusion, that most probably the defendant (doctor) was negligent, and the negligence caused the injury. In other words, it is a reasonable conclusions from the circumstances, that it was undoubtedly the doctors fault.
- The plaintiff (patient) does not have to prove that the act was negligent as it could be nothing else. It is for the doctor to prove if he can, that the negligence was not his doing.
- Examples: Amputation of wrong limb.
- Leaving a swab or instrument in the patient after operation.
- Operating wrong part.

Medical Indemnity Insurance

It is the contract between the insurance company and the doctor to compensate in professional negligence, in return for the payment of premiums.

Objectives

- ❖ To protect the professional interest of the doctor.
- ❖ To pay for the conduct of defence of doctor in medical negligence.
- ❖ To compensate the amount the court declares to the opposite party.

16.7 Medical Records

- ❖ These are the documents containing a chronologically written account of the patient's medical history, complaints, physical findings, results of diagnostic tests, medications, therapeutic procedures and daywise progress notes.
- ❖ This can be used as an evidence in the court of law in medical negligent cases, for third party insurance claims, life insurance policies, accidental death claims, etc.
- ❖ Medical records are the property of the hospital, and the personal data in the records are confidential. The original hospital record of the medico-legal case including X-ray, CT scan report and MRI report need not be handed over to police.
- ❖ However, if the investigating officer requests, a photo copy of the records can be given and a receipt of the same is to be obtained.
- ❖ If the patient or relatives ask for records, a photocopy of the same should be given within 72 hours.
- ❖ The patient's record cannot be used in educational or diagnostic conferences

or clinics or for publications without the patient's consent.

- ❖ Hospital records can be used for statistical purposes without the consent of the patient.
- ❖ Medical records should be kept in the hospital for at least 10 years.

Medico-legal reports and postmortem certificates

The original should be sent to the concerned court and one copy to the concerned police station. Victim/relative of the deceased can get a copy of the same if requested.

These are not public documents. These cannot be issued to third parties (including accused) under RTI Act. It clearly states that document which affects the privacy of a person is exempted from right to information.

16.8 Consumer Protection Act (CPA/COPRA) 1986

Amended in 1991, 1993, 2002 and 2019

Consumer Protection Act-1986

This Act is enacted for protecting the interests of the consumer and provides for establishment of consumer councils, or forums for this purpose. The district, state and national commissions have been established to deal with the complaints of the consumers. They provide speedy and simple solution to consumer disputes.

The Consumer Protection Act 2019 protects the interest of the consumers. This Act helps to save the rights of the consumers by establishing authorities for timely and effective administration and settlement of consumer disputes.

Consumer protection authority (CCPA) formed under the Act protects, promotes and enforces the rights of consumers. According

to the Act, the consumer can file complaint at the place where he lives.

The consumer dispute redressal agencies are:

1. District forum: It is headed by a district judge. It decides the case where compensation is up to 1 core.
2. State commission: It is headed by a high court judge. It decides the case where compensation is up to 10 core. It is the appellate authority for district.
3. National consumer commission: It is the apex consumer body presided by supreme court judge. It decides on cases where a compensation is more than 10 crores. It is appellate authority for the state forum.
4. Supreme Court: It is the final appellate authority.
 - Complaint has to filed in the district forum in a period of 2 years.
 - No court fee is taken.
 - The decision should be taken by the redressal forum within 90 days, which may be extended to 150 days.
 - Higher authority can be reached for the appeal against the order issued by the form within 30 days from the date of order.
 - The district forum has the same power as are vested in civil court.
 - Both parties can appeal to the state and even national redressal forum and finally supreme court can be reached.
 - The consumer courts have the power of attachment of property of the opposite party. The district collector will play an important role in the recovery of the amount from the opposite party.
 - According to the new Act, court can refer for settlement through mediation cells attached to district and state commission.

- If the complaint proved fake, the complainant is ordered to pay a compensation to the opposite party not less than Rs.10,000.
- Doctors and hospitals come under Consumer Protection Act. Medical practitioners and hospitals are liable for the act of any medical negligence.
- All govt hospitals paying or non-paying and private hospitals and

nursing homes comes under Sec 2(1) of this Act.

- All patients whether paying or non-paying come under purview of this Act.
- Doctors are liable to pay compensation to the patient due to their professional negligence resulted in injury or death.
- All goods and services will come under COPRA. Provision for e-commerce is also included.

Summary

Charaka Sapath or Charaka Oath

It is the content or part of the text book Charaka Samhita Ayurveda text. The content in the passage is considered as Charaka Sapatha is written in the form of a set of instructions by a teacher to prospective students of science of medicine. According to Charaka Samhita the unconditional agreement to abide by these instructions is a necessary precondition to be eligible to be taught in the science of medicine. This gives explicit instructions on the necessity of practicing asceticism during student life, student teacher relationship, the importance of committing oneself fully and completely for the wellbeing of the patient, whom to treat, how to behave with women, and several other related issues. This is taken from paragraph number 13-14 of Charaka Samhita Vimana sthana.

Ethics

Ethics are defined as a set of moral principles or values.

Etiquette is defined as the conduct or procedure required or prescribed by authority to be observed in official life.

Duties of Physicians in General

- ❖ A physician shall always exercise his/her independent professional judgment and maintain the highest standards of professional conduct.
- ❖ A physician shall respect a competent patient's right to accept or refuse treatment.
- ❖ A physician shall not allow his/her judgment to be influenced by personal profit or unfair discrimination.
- ❖ A physician shall be dedicated to providing competent medical service in full professional and moral independence, with compassion and respect for human dignity.
- ❖ A physician shall deal honestly with patients and colleagues, and report to the appropriate authorities those physicians who practice unethically or incompetently or who engage in fraud or deception.
- ❖ A physician shall not receive any financial benefits or other incentives solely for referring patients or prescribing specific products.

- ❖ A physician shall respect the rights and preferences of patients, colleagues, and other health professionals.
- ❖ A physician shall recognize his/her important role in educating the public but should use due caution in divulging discoveries or new techniques or treatment through non-professional channels.
- ❖ A physician shall certify only that which he/she has personally verified.
- ❖ A physician shall strive to use health care resources in the best way to benefit patients and their community.
- ❖ A physician shall seek appropriate care and attention if he/she suffers from mental or physical illness.
- ❖ A physician shall respect the local and national codes of ethics.

NCISM

About National Commission for Indian System of Medicine

The National Commission for Indian System of Medicine was formed in 2020 by the Government of India as statutory board by passing The National Commission for Indian System of Medicine (NCISM) Bill. The bill was passed in the Lok Sabha, in August 2021, and replaced Indian Medicine Central Council Act, 1970.

The National Commission for Indian System of Medicine set up according to the National Commission for Indian System of Medicine Act, 2021, governs the Board of Ayurveda and Unani and the Board of Unani, Siddha and Sowaigpa.

CONSENT

Consent is a free and voluntary agreement, approval or permission for compliance of some act. It is valid only when given after

knowing the nature and consequence of the consent and fact for which the consent is given.

Types

1. Implied consent
2. Expressed consent
 - Oral consent
 - Written consent

Professional secrecy

- ❖ It is an implied term of contract between the medical practitioner and his patients whereby the doctor is obliged to keep an inviolable secrets all that comes to his knowledge about patients in course of his professional work.
- ❖ Hippocratic Oath and declaration of Geneva require adherence to professional secrecy.
- ❖ All information about patient/illness/family be kept confidential.
- ❖ Doctor should maintain highest degree of confidentiality.

Privileged Communication

- ❖ It is the statement made by a medical practitioner to the authorities concerned in the interest of the community or the public towards whom he has legal social or moral duty.
- ❖ The communication must be under circumstances that indicate confidentiality is expected.
- ❖ Relationship between the individuals must be recognized as entitled to a privilege.
- ❖ Parties must not reveal confidential statements to others.
- ❖ Privileged communications are admissible only if there is an exception to the privilege that covers the communication.

Medical Negligence

- ❖ It is the failure to do what a reasonable healthcare provider would have done under similar circumstances.
- ❖ Reasonable healthcare providers usually follow the national/regional/local standards of care and their own policies and procedures.
- ❖ IPC 304 A says causing death by negligence: whoever causes the death of any person by doing rash or negligent act not amounting to culpable homicide shall be punished with imprisonment of either description for a term which may extend to 2 years, with or without fine.

In a Medical negligence there must be 4 elements :

1. Duty of care
2. Dereliction of duty/breach of duty
3. Damage(Injury/death)
4. Direct causation

Professional Misconduct

It is the act of a medical professionals which is regarded as disgraceful or dishonorable in terms of his profession.

No punishment is mentioned in IPC, so Medical council usually take action by removing name of doctor from medical register (penal erasure/professional death sentence)

Common misconduct/ infamous conduct

- | | |
|--------------|----------------|
| 1. Abortion | 4. Association |
| 2. Adultery | 5. Alcohol |
| 3. Addiction | 6. Advertising |

Medical Records

- ❖ It is an orderly written document encompassing the patient's identification data, health history, physical examination findings, the surgical procedures, and hospital course.
- ❖ It is a documentary evidence in court.
- ❖ When complete it should contain sufficient data to justify the investigations, diagnosis treatments, length of hospital stay, result of care, future course of action.
- ❖ It also provides the management with the statistical information necessary for decision making regarding the utilization of resources.
- ❖ It protects the hospital in the event of legal action.
- ❖ Good medical records (MR) should be complete, adequate and accurate.
- ❖ Consumer protection act.
- ❖ CPA (Consumer Protection Act) 2019 replaced the CPA 1986 to provide timely administration and settlement of consumer's dispute.
- ❖ The new act empowers and protects the rights of consumers through various notified rules and provisions related to—
 - Consumer protection councils
 - Consumer Disputes Redressal commissions
 - Mediation
 - Product liability
 - Rules on e-commerce and direct selling
 - Penalty for adulterant and spurious goods.

Differences of CPA Old (1986) and New (2019)

Provision	CPA 1986	CPA 2019
Regulator	No central regulator	Central consumer protection authority to be set up

Provision	CPA 1986	CPA 2019
Filing of complaint	A complaint needs to be filed in the consumer court where the sellers (defendant's) office is located	A complaint needs to be filed in the consumer court where the complainant resides or works
Product liability	No provision Consume could approach a civil court but not consumer court	Consumer can seek compensation for harm caused by a product or service
Pecuniary jurisdiction	District: up to Rs.20 lakhs State: up to 20 lakhs -1 crore National: above 1 crore	District: up to Rs.1crore State: from 1 crore-10 crore National: above 10 Crore
E-commerce	No provision	All rules of direct selling extended to e-commerce
Mediation cells	No legal provisions	Court can refer settlement through mediation.

Important Questions MCQ

- The Vaidya, who protects prana and kills disease**
 - Pranabhisara
 - Rogabhisara
 - Kuvaidya
 - All the above
- NCISM was enacted in the year**
 - 1971
 - 2021
 - 1970
 - 2000
- Written and oral consent comes under**
 - Implied
 - Expressed
 - Common consent
 - All of the above
- Rule of full disclosure is also known as**
 - Expressed consent
 - Informed consent
 - Implied consent
 - Therapeutic mis adventure
- Minimum age of consent is**
 - 12 yrs
 - 13 yrs
 - 18 yrs
 - 21 years
- Doctor is obliged to keep secrets of all information of patients is known as**
 - Professional secrecy
 - Privileged communication
 - Vicarious liability
 - Criminal negligence
- The doctor can reveal some information regarding patient to protect the interest of the public.**
 - Professional secrecy
 - Privileged communication
 - Vicarious liability
 - Criminal negligence
- The doctor is bound to inform police about a suspected crime under**
 - CrPC 174
 - CrPC 39
 - IPC 176
 - Both b&c
- Negligence is punishable under**
 - IPC 304 A
 - IPC 302
 - IPC 299
 - IPC 176
- Contributory negligence can be used as a good defence in**
 - Civil negligence
 - Criminal negligence
 - Corporate negligence
 - Death due to negligence
- 4D is mentioned for**
 - Consent
 - Ethics
 - Euthanasia
 - Negligence

12. 6A are said for
 a. Negligence
 b. Infamous conduct
 c. Consent
 d. COPRA act
13. Respondant superior is also known as
 a. Novus actus intervenes
 b. Vicarious liability

- c. Res Ipsa loquitor
 d. Negligence

Answer Key

1. a	2. b	3. b	4. b	5. a
6. a	7. b	8. d	9. a	10. a
11. d	12. b	13. b		

Learning Objectives

- Describe Vaidya sadvritta, code of medical ethics, code of conduct, Charaka oath and Hippocratic oath.
- Describe constitution, objectives and functions of NCISM.
- Describe the duties, rights and privileges of Registered Medical Practitioner.
- Describe consent, professional secrecy and privileged communication.
- Describe professional negligence, professional misconduct and unethical practice.
- Describe the maintenance of Medical Records and Consumer Protection Act (CPA).

Important SAQ

- Explain negligence.
- Different between civil negligence and criminal negligence.
- Explain the types of consent.
- Briefly explain Consumer Protection Act.
- Briefly explain infamous conduct.

• • •

Legal Procedures

17.1 Courts and their Powers

Courts of Law

Courts of Law are of Two types

1. Civil court
2. Criminal court

Civil courts in India deal with cases related to disputes between two parties. Criminal courts are established to solve serious crimes such as assault, robbery, murder, arson, rape and other kinds of crimes.

Courts in India

1. Supreme Court

It is the highest judicial body in India and is located in New Delhi. It has supreme power overall all the courts in India. Supreme Court judges are appointed by President of India. It is the final court of appeal for all civil and criminal cases in India. It also has the power of judicial review. The Supreme Courts which consist of Chief Justice of India and a maximum of fellow 33 judges, has extensive power in the form of original, appellate and advisory jurisdictions.

2. High Courts

High court is the highest tribunal in the state. High Court judges are also appointed

by the President of India. It can try any offence and pass any sentences prescribed by Law (Sec.28- CrPC). It also acts as a court of appeal when an appeal is given by the aggrieved party against a lower court order. The death sentence passed by sessions court should be confirmed by the High Court. In India, it is usually located at the capital/ state headquarters. Also, some states in India like Goa, Arunachal Pradesh, Mizoram and Nagaland do not have High Court.

3. Sessions Court

It is located at every district. It can try cases committed by judicial magistrate. It can pass any sentences authorised by law. Death sentence must be confirmed by the high court (Sec.28 CrPC). **Additional Sessions Courts and Additional Sessions Fast Track Courts** are also sessions courts constituted to settle the cases faster. They have the same power as the sessions courts.

Sessions court judge is called District Judge, while presiding over civil cases. Sessions judges are appointed by the state government in consultation with the High Court or by the elevation of judges from subordinate courts.

4. Assistant Sessions Court

It can pass sentence of imprisonment up to 10 years and impose unlimited fine.

5. Magistrates

1. **Judicial magistrates:** They are appointed by High Court.

They are of three types:

- Chief judicial magistrate
- First class judicial magistrates
- Second class judicial magistrates

2. **Executive magistrate court**

Special Magistrates

- ❖ These are the Judicial Magistrates or Metropolitan magistrates appointed for special purposes. e.g. **Juvenile Justice Board (Juvenile Court)**.
- ❖ These are courts established under Juvenile Justice Act (Care and Protection of Children) Act 2000, for the trial of juvenile cases, when the accused is below 18 years of age. Under this Juvenile Justice Act, a judicial first class magistrate or metropolitan magistrate is appointed to conduct the trial in juvenile court.
- ❖ As per the Act, the juvenile means a person who has not completed 18 years. As per this Act, **Juvenile Justice Boards** are constituted in each state. The board shall consist of a Judicial First Class Magistrate (metropolitan magistrate) who is appointed to conduct the trial in juvenile court and 2 social workers, one shall be a woman. Each such member will have the power of first class Judicial Magistrate.
- ❖ If a juvenile is found as guilty for a serious offence, he/she is not given life imprisonment or committed to prison, but is sent to a reformatory school. The juvenile should not be detained for more than 3 years, or should be release on completing 18 years. **As per the latest amendment in 2015, for heinous crimes like rape, murder, etc. person above 16 years will be considered as adults.**

Family Courts

They are established under the provision of the Family Courts Act (1984) by the state government in consultation with the high courts to promote concillation and secure speedy settlement of disputes relating to marriage and family affairs. As per this Act, it is mandatory for the state government to set up a family court for every city or a town whose population exceeds 1 million. It can deal with both civil and criminal matters related to marriage and family affairs. Judges of the family courts are appointed by state government. District judge or magistrate hears the case.

Labour Courts

The appropriate government, by the Gazette notification, constitutes labour courts, for the adjudication of the industrial disputes. The Labour Courts consists of 3 members only, a judge of High Court (minimum 3 years of experience), a district judge (at least 7 years of experience), a deputy chief of labour commission, or an officer of Indian Legal Service. (see the table next page)

Punishments described in Indian Penal Court

1. Death
2. Imprisonment for life
3. Simple imprisonment
4. Rigorous imprisonment, i.e. with hard labour
5. Forfeiture of property
6. Fine
7. Sending to juvenile homes for rehabilitation of juvenile offenders,

Capital Punishments

Different countries have different methods of execution. In India, it is done by hanging. Other countries have other execution

Criminal Courts in India

S. No.	Courts	Location	Powers
1.	Supreme Court	New Delhi	Highest judiciary tribunal of the country, can pass any sentence, usually considers appeals from the lower courts.
2.	High Court	Capital of every state (usually)	Highest judicial tribunal of the state, can try any offences and pass any sentences.
3.	Sessions court (district sessions court)	District headquarters	Highest judicial tribunal of the district. Can try only those offences which have been committed to it by a magistrate. Can pass any sentences, but death sentence must be confirmed by High Court.
4.	Magistrate courts • Chief judicial magistrate • Judicial magistrate of first class • Judicial magistrate of second class	District headquarters Subdivision of district Subdivision of district	Can pass a sentence of imprisonment up to 7 years, fine without limit. Can pass sentence of imprisonment up to 3 years, fine up to Rs.10,000. Can pass sentence of imprisonment up to 1 year, fine up to Rs.5,000.
	Executive magistrate courts	District sub-division	Appointed by the state government, usually officers of Revenue dept., district collector, sub collector or tahasildar.

methods like electrocution, lethal injections of thiopental sodium, potassium chloride, curare, etc., garroting, gas chamber and decapitation.

17.2 Inquest, Evidence and Witness

Inquest

Inquest is a legal inquiry into the circumstances and causes of death in cases of sudden, suspicious or unnatural deaths like suicide, murder, accidents, killing by animals or machinery, traffic accidents and suspicious deaths.

Types of inquest: Commonly encountered in India are:

1. Police inquest
2. Magistrates inquest

Other types of inquest

3. Coroner's inquest
4. Medical examiner's system
5. Procurator fiscal

1. Police Inquest (Sec.174, CrPC)

- ❖ Done overall in India
- ❖ The police in-charge of police station, usually police officer not below the rank of sub-inspector (SI)
- ❖ Usually conducted in (a) suicide, accident, killed by another person or an animal or machinery (b) when there is a suspicion that someone has killed the person and (c) death of a woman (suicide/homicide) within 7 years of her marriage and any relative of the woman who has made a request in her behalf.

Procedure

- ❖ On receipt of the information of sudden or unnatural death, the police officer informs the nearest magistrate (executive) and proceeds to the place of death.
- ❖ The police officer who reaches the place is called investigating officer (IO) who then starts inquest. It is done in the presence of

2 or more respectable inhabitants called Panchas.

❖ IO inspects the injuries, and fractures present in the dead body and he should mention these injuries in writing on paper with the help of diagrams. He also mentions the type of weapon responsible for the injuries and the manner of death (suicidal, accidental, homicidal).

❖ IO also writes the brief facts, views and information from the panchas on paper.

❖ Then he arranges all these papers to prepare an inquest report (also known as panchanama) and then mentions the 'apparent cause of death'.

❖ This panchanama is then signed by IO himself and the panchas.

❖ Then IO forwards this inquest report (panchanama) to the district magistrate.

If foul play suspected

❖ IO forwards the body for the postmortem examination, (i.e. autopsy), to the nearest govt hospital along with the inquest report (panchanama). The forwarding of the body should only be done if there is no risk of putrefaction, on the road, which would render the examination useless. He then writes an application requesting PM examination and attaches the application with the inquest papers. Lastly, he presents these inquest papers along with application to the autopsy surgeon for conducting PM examination.

❖ After autopsy: If autopsy report confirms the unnatural cause, then further enquiry and trial of the case is conducted by a magistrate concerned, to whom the entire records of the case are transferred by IO.

❖ Police officer has power to call/summon a person (S.175 of CrPC) who appears to know the facts of the case and the person

is bound to attend the answer the question put to him. Refusal to answer question is punishable under S.IPC 179 with punishment of 6 months of imprisonment and fine of Rs.1000/- or both.

❖ It is the most common type of inquest in India, but its quality is inferior to that of Magistrate inquest.

2. Magistrate Inquest (S.CrPC-176)

It is the inquest conducted by executive magistrates including :

1. Collector (District Magistrate)
2. Deputy Collector
3. Revenue Divisional Officer (RDO), also called Sub Divisional Magistrate (SDM)
4. Tahsildar

Executive magistrates are appointed by the state govt.

In certain conditions, the responsibility of an inquest is given to the magistrate by assuming that it is not always safe or advisable to rely upon the inquest conducted by police.

Indicated situation

1. Death (suicide or homicide) of a woman within 7 years of marriage, does not matter whether the allegation is dowry related or not.
2. Dowry death (IPC 304.B)
3. Death in police custody or judicial custody or any other custody authorised by magistrate or court like psychiatric hospital and children's home.
4. Exhumation (digging out)
5. Death in police custody / prison death
6. Death due to police firing

Magistrate inquiry or Investigation (not inquest)

❖ If a person disappears from police custody

- ❖ Rape is alleged to have been committed on any woman while in police custody or any other custody authorised by a magistrate or a court.

Powers of Magistrate

1. Magistrate may conduct inquest either instead of or in addition to the investigation conducted by the police officer.
2. The proceedings of magistrate are not judicial proceedings; these proceedings only try to find out the cause of death.

Postmortem Examination: After inquest, the body is sent for PM examination or autopsy. The inquest papers must be handed over to the autopsy surgeon for information. During the investigation, the magistrate shall inform the relatives of the deceased and allow them to stay during investigation.

Quality: Magistrate inquest is of superior quality as compared to police inquest, so it is the best type of inquest in India.

3. Coroner's Inquest

Coroner's inquest is the inquest conducted by the coroner. In history, coroner was the officer appointed by the king to look into the cause of death. Coroner is an officer (lawyer, doctor or both) of the rank of first class Judicial Magistrate. In India, coroner's inquiry system was introduced by the British in the presidency town of Kolkata, Mumbai and Madras (Chennai) as per Coroners Act 1871. Now in India nowhere this system is followed. But it is followed in countries like UK, US, Canada and Australia.

It is similar to magistrate inquest in quality. Coroner's court is a court of enquiry and not a court of trial. He is not an authorised person to pass judgment on the case.

4. Medical Examiner's System

It is the inquest done by medical examiner who is a qualified expert, legally and medically, especially a forensic pathologist.

Performs 2 Duties

- ❖ He visits the scene of crime to get firsthand information regarding the circumstances of death.
- ❖ He conducts Postmortem examination on dead bodies after visiting the scene of crime.

He submits his report to the district attorney for further action.

It is the best inquest practiced among the above said **four**. There is no such system in India.

5. Procurator Fiscal System

This is conducted in Scotland.

Evidences

According to Sec 3 of IEA, the statements of witnesses and documents produced for inspection of the court are called evidences. They are of two types:

1. Documentary evidences
2. Oral evidences

Documentary Evidences

All the documents that are produced for inspection before the court are documentary evidences. (**Sec.3 of IEA**)

They are :

1. Medical certificates
2. Medicolegal reports
3. Dying declaration

Medical certificates

- ❖ Certificates of illness
- ❖ Certificates of fitness
- ❖ Certificate of age

- ❖ Certificate of mental illness
- ❖ Disability certificate
- ❖ Birth certificate
- ❖ Death certificate

Medicolegal reports/certificate

- ❖ Postmortem certificates
- ❖ Wound certificates.
- ❖ Report after examination of accused of sexual offence
- ❖ Examination of drunkenness
- ❖ Potency examination
- ❖ Examination of a woman for pregnancy.
- ❖ Examination of woman for recent delivery.
- ❖ Issuing false certificates is called perjury (IPC 191), punishment of imprisonment of 7 years and erasure of name from the register (IPC 197).

Dying Declaration

It is a **written or oral statement** of a person, who is going to die as a result of some unlawful act, relating to the cause and circumstances of his death. (**Sec.32 IEA & 157 IEA**)

Procedure

- ❖ Judicial magistrate is empowered to record the dying declaration.
- ❖ Police can make necessary arrangements for taking dying declaration.
- ❖ Before start recording the evidence, the doctor has to certify that the person is conscious and his mental faculties are normal (*compos mentis*).
- ❖ There is no need of taking oath before taking the dying declaration because it is assumed that the dying person will tell the truth when he is on the verge of dying.
- ❖ Declaration should be taken in victim's own words, no leading questions, no

prompting or no suggestions should be made to the declarant and undue influences must not be imposed on the declarant.

- ❖ After recording the dying declaration it should be read over to the person and get it signed or thumb impressions should be taken.
- ❖ If the dying person is unable to speak but he is able to make gestures, or signs as answer to the questions, the questions and also the signs are to be recorded.
- ❖ If the declarant become unconscious, the recording should be stopped at that point
- ❖ If the patient's condition is serious and there is no time for the magistrate to reach the place, doctor can start recording the dying declaration in the presence of two witnesses.
- ❖ After taking the dying declaration it should be signed by the doctor and the witness.
- ❖ It should be sent to the magistrate in a sealed cover.
- ❖ Its evidential value is lesser than that is taken by magistrate.
- ❖ Statement of dying declaration can also be recorded by a village headman or police as his dying declaration but its evidential value is less.
- ❖ If the declarant survives the dying declaration is not admitted but has a corroborative value and the person is called by the court to give oral evidence.

Dying Deposition

It is the dying declaration taken by the magistrate in the presence of the accused persons or his lawyer who is allowed to cross examine the declarant. Leading questions are not allowed while taking the deposition. The declarant should take oath before

giving dying deposition. It is considered something like a bed side court and has more evidential value as victim on the bed, accused and magistrate are present nearby, oath should be taken during proceedings. So it is considered as a Bedside court. This procedure is not followed in India.

Dying declaration	Dying deposition
Made to judicial magistrate or medical officer	Judicial magistrate only
Oath is not needed	Oath is needed
Accused not present	Accused/his lawyer
Cross-examination not permitted	Cross-examination permitted
Practiced in India	Not practiced in India
Lesser legal value	More legal value

Oral Evidences

Oral evidence is the evidence tendered verbally or as statements in the witness box. It is of –

1. **Direct oral evidence:** This is what the witness saw or heard or perceived by the senses.
2. **Hearsay evidence:** This is what the witness heard or perceived from other persons who witnessed the offence, and has not directly witnessed. A gives evidence in the witness box that B had informed that he had seen that C committing a crime. Here A is given hearsay evidence and B is the direct witness. So B can be called to give direct evidence. Hearsay evidence has lesser value than direct evidence.

If court requires some material object (MO) related with the oral evidence given, it should be produced before the court.

Oral evidence is superior and more reliable than documentary evidence as it can be cross-examined. Documentary evidence is accepted by oral testimony of the concerned person.

There are which few documentary evidences are usually exempted from oral evidence:

1. Dying declaration
2. Expert opinion expressed in a treatise or book when the author is dead.
3. Evidence of an expert witness recorded in the lower court.
4. Evidence given by a witness in the lower court.
5. Reports of certain scientific experts; (FSL certificates) e.g.
 - Chemical examiner
 - Chief inspector of explosives
 - Director of fingerprints
 - Serologist to govt
6. Public records
7. Hospital records

Circumstantial Evidence

It is the evidence obtained from suspicious circumstances. For example, the sudden disappearance of a person who is suspected to be the criminal. In some cases, circumstantial evidence is found to be more reliable than eyewitness accounts. It can be considered as a indirect evidence.

Witness

Witness is the person who provides evidence about a fact in the court of law, **under oath** and **being summoned** by the court.

Any person can be a witness unless suffering from mental illness. There is no age limit for witness.

Witness are of two types:

1. Common witness
2. Expert witness

Common Witness

Common or ordinary witness is that person who testifies, only to the facts he

has observed, heard or perceived. He gives firsthand knowledge. His evidence requires only common intelligence and knowledge. He is not capable of forming an opinion and drawing conclusions from the facts observed by him.

Example: A has seen that B is stabbing C with a knife. In the above case A is the common witness, even a dumb person can be a common witness.

Expert Witness

Expert witness is a person who is trained or skilled in a technical or a particular scientific subject or foreign law, art, or science and capable of forming opinions and drawing inference on the observations, made by him or by others. Such persons are experts and their testimony is expert witness. (Sec.45 IEA)

Examples

1. Doctor
2. Firearm experts
3. Fingerprint experts
4. Handwriting experts
5. Experts in DNA analysis
6. Chief chemical examiner to the Govt.
7. Serologists report to Govt.

An expert witness can volunteer a statement if he feels that justice is likely to be miscarried.

Hostile witness

Hostile witness is one who speaks just opposite to what he has stated earlier. He deliberately conceals the truth or gives false evidence. After making a particular statement in court, he contradicts subsequently. He is therefore presumed to have an interest or motive for concealing the truth or giving false evidence. The court therefore declares him to be hostile. **When hostile witness is being**

examined, leading questions are permissible even during examination in chief.

Perjury

The willful utterance of falsehood in the court of law by the witness under oath or failure to tell what he knows or believes to be true (IPC 191) is called perjury. Witness is liable to be prosecuted for perjury, and imprisonment may extend up to 7 years, and also liable for fine (IPC 193).

17.3 Court Procedures: Summons, Oath, Recording of Evidence, and Conduct Money

Record of evidence in the court – (Sec. 137-159 IEA)

1. Oath (S.IPC 51)
2. Examination in chief (S.137-142 IEA)
3. Cross examination (S.137-146 IEA)
4. Re-examination (S.137-138 IEA)
5. Court questions (S.165 IEA, Sec.311 CrPC)

Procedure of calling a witness in the court of law Subpoena/Summons

Subpoena or summons is the document commanding the attendance of a witness in the court of law, under a penalty. (*sub*-under, *poena*- penalty):

- ❖ A summons is issued by the court, in writing signed by the presiding officer, and is served to the witness by a police officer, of the court or any other person specifically authorised for the purpose.
- ❖ Summons is issued in duplicates, one of which is to be returned after signing, while the other is retained by the witness.
- ❖ A summons must be implicitly obeyed unless there are valid and urgent reasons. A witness who willfully avoids to appear in the court after receiving the summons is found as guilty of

contempt of court. The penalty for non-compliance of summons is a warrant of arrest and compulsory appearance before the court.

- ❖ Regarding the matter of attending a court in response to a summons, it must be borne in mind that a witness must give priority to a criminal case over a civil case.
- ❖ If he summoned by two criminal courts on the same day he is to give preference to the higher court, which takes precedence over a lower court.
- ❖ **Conduct money:** In civil cases, the medical officer is usually paid an amount of money to meet his travel expenses, from his place of residence to the court and back. This is called conduct money. This is paid to him at the time of serving the summons. If the amount is not paid to him, he may ignore the summons if he so desires. If he feels the sum is inadequate, he can inform the court accordingly and get it enhanced. In criminal cases, however usually no such fee is given, and it is the duty of every citizen to attend the court whenever summoned.

Procedures in Court

1. Oath (Sec.51 IPC)

- ❖ Is a declaration required by the law which is compulsory for a witness before he gives evidence.
- ❖ Witness has to take an oath before giving the evidence and is compulsory.
- ❖ By taking the oath, the person becomes legally bound to state/speak the truth during evidence.
- ❖ An oath makes the witness responsible for the consequences of his evidence.
- ❖ The witness should take the oath as follows. "I swear in the name of god, what I shall tell be the truth, whole truth and nothing but the truth".

- ❖ If the witness is an atheist, he has to "solemnly affirm".
- ❖ If the witness is below 12 years of age, there is no need of taking oath.
- ❖ Punishment for refusal of taking oath: imprisonment of 6 months and fine of Rs.1,000.

2. Examination in Chief – direct examination (Sec.137 – 142 IEA)

- ❖ This is the examination by the lawyer or the counsel who have summoned him.
- ❖ This is the first examination.
- ❖ In a criminal case, PP (public prosecutor) first examines the witness.
- ❖ The main purpose of examination in chief is to place all the facts known to the witness before the court.
- ❖ The doctor summoned is appeared as an expert witness. He gives evidence from medical report he had submitted earlier. He also testifies that the report submitted was prepared and signed by him. Usually he has to answer questions like :
 - When he saw the body
 - Time of conduction of PM examination
 - Injuries- description and/or duration of infliction
 - Weapon of offence
 - Opinion regarding the cause of death
- ❖ No leading questions are allowed in this examination in chief (Sec. IEA 142) except in 2 situations :
 - When the court permits to ask leading question during examination in chief
 - When the witness is declared 'hostile' by the court.

Example of leading questions: "was the stab penetrating the heart?" The answer is Yes or No. Instead of the above question, he has to ask: "What was the nature of Injury?"

3. Cross Examination

The witness is questioned by the lawyer of the opposite party, i.e. lawyer of the accused (defence lawyer). The objectives are:

1. To elicit the facts favourable to his case
2. To test the accuracy of the statement of the witness
3. To modify his statements, and bring other possibilities.
4. To establish that the witness is not reliable.
5. To remove undue emphasis to certain facts :

- In cross examination, the defence lawyer will try to weaken the evidence given by the witness in the examination in chief. He will elicit points favourable to the defence side and for this, he will try to establish that the evidence given by the witness was conflicting and contrary. So the witness must be very careful in answering questions during cross examinations.
- There is no time limit for cross examination, the witness may be cross-examined even for days together.
- Leading questions are allowed in this (Sec.143 IEA).
- The doctor should not be biased.
- He should stick to science while answering questions, his interpretation should be scientific.
- Doctor should not lose his control by becoming nervous, angry or tensed.

4. Re-examination (Sec. IEA 137, 138)

- ❖ After-cross examination, the party which summoned him (prosecutor) can cross-examine him to clarify the questions put forward in cross-examination.

- ❖ It is an opportunity for the witness to explain more, fully, or some matter which may be damaging to the prosecution.
- ❖ No new matter can be introduced in this and, no leading questions are allowed.
- ❖ The opposite lawyer has to re-cross examine the witness on the new matter introduced in re-examination.

Court questions

These are that questions put forward by the presiding officer of the court. These questions are posed to clear doubts, if any, and can be asked at any stage of the trial proceedings.

17.4 Conduct of a Medical Professional in the Court of Law

A doctor should remember and follow the following points when he attends a court as a witness:

1. Be well prepared before entering the witness box, and anticipate some probable questions.
2. Take relevant records with you.
3. Do not discuss the case with anybody except prosecutor.
4. Speak clearly, distinctly, audibly and with assurance.
5. Avoid exaggerations and superlatives, use simple language. Avoid technical terms as far as possible.
6. If a question is not understood, you can ask the lawyer to explain it better.
7. If you feel your answer to a particular question does not reflect the whole truth, then with the permission of the court, you can volunteer a statement and tell the truth.
8. Sometimes a particular statement from a book is pointed out and asked whether you agree with that or not. You have to

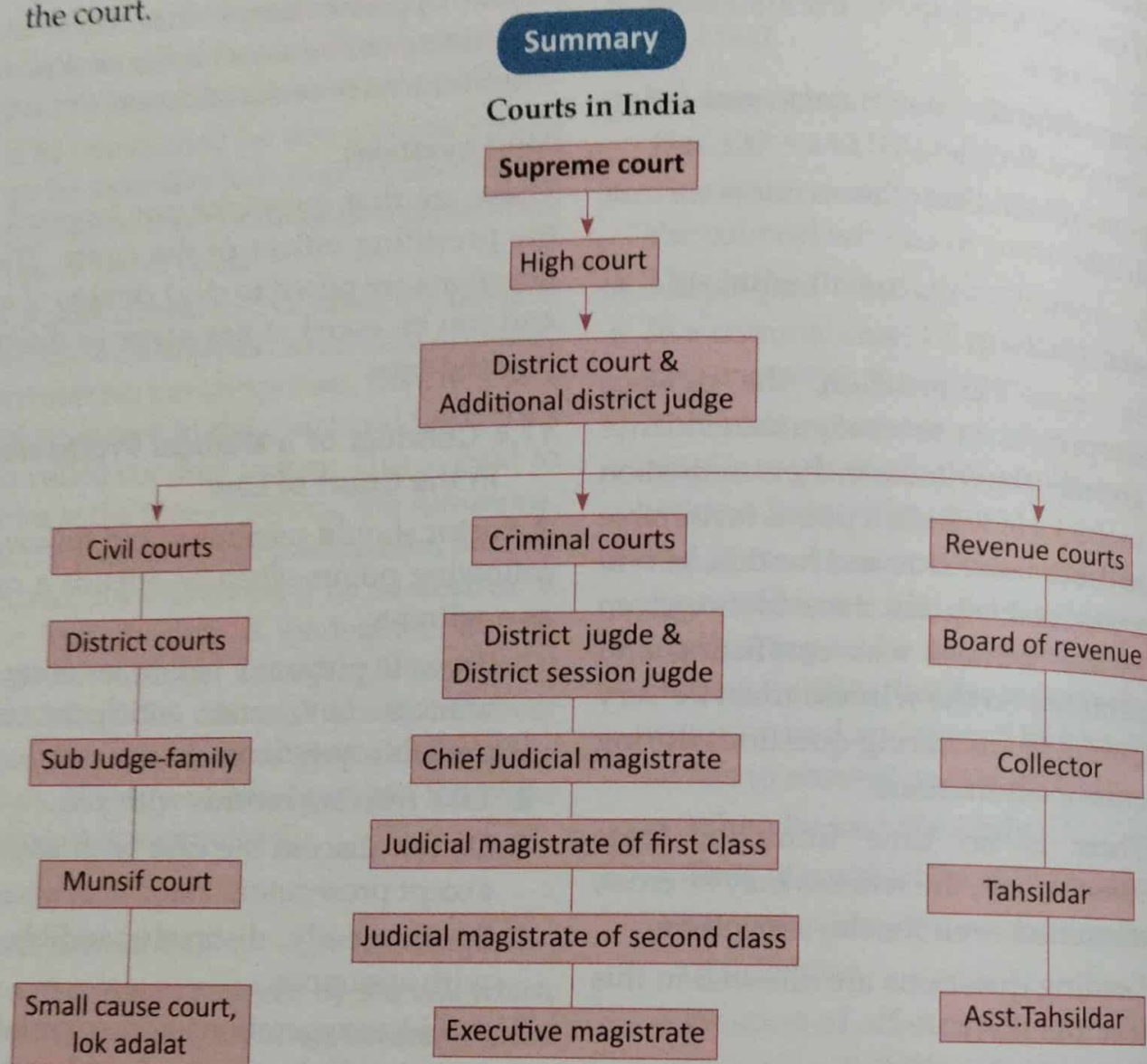
read the whole related paragraphs, think about it and express your opinion. You can agree or disagree with a particular statement giving the reasons for that.

9. Be pleasant, polite, and courteous in the court.

10. Do not lose your temper.

11. Do not become hostile, angry or rude.

12. You have to address the judge, "your honour".



Court procedures

- ❖ Summons
- ❖ Oath taking
- ❖ Examination in chief
- ❖ Cross examination
- ❖ Re examination
- ❖ Court questions

Inquest

It is an inquiry or investigation into the cause of an sudden suspicious and unnatural death

Types –mainly practiced in India

1. Police inquest
2. Magistrate's inquest

Evidence

Anything legally submitted to a court of law that helps ascertain, the truth of the matter unde investigation

The most important concept in criminalistics is the identification of evidence

Types

- ❖ Oral
- ❖ Documentary
- ❖ Circumstantial

Witness

Witness is a person who gives sworn testimony or evidence in the court of law, in relation to matters of facts under inquiry.

Any person can testify as witness or give evidence.

He should be able to understand the nature of questions.

Types

1. Common witness
2. Expert witness

3. Hostile witness

Code of conduct of a medial professional in the court of law

- ❖ After getting summons a doctor must attend the court punctually.
- ❖ Be well prepared with details of the particular case before entering the witness box.
- ❖ Carry all records and relevant reports that may have to be quoted in the box.
- ❖ Be well dressed, modest, always in time
- ❖ Never attempt to memorize
- ❖ Stand up straight
- ❖ Never discuss the case with anyone
- ❖ Be relaxed and calm

Important Questions**MCQ**

1. In India magistrate inquest is done in all cases except

- a. Police firing
- b. Murder
- c. Custodial death
- d. Dowry death

2. In case of death in psychiatric hospitals, inquest is done by

- a. Police inquest
- b. Medical examiner's system
- c. Coroner's inquest
- d. Magistrate inquest

3. Chief judicial magistrate can give a punishment of

- a. 7 years
- b. 5 years
- c. 3 years
- d. 1 year

4. Death sentence cannot be passed by

- a. High court
- b. Sessions court

c. Magistrate court

d. Supreme court

5. Juvenile is the one who is less than

- a. 15 years
- b. 16 years
- c. 21 years
- d. 18 years

6. Minimum age bar for taking oath in court

- a. 10 years
- b. 12 years
- c. 18 years
- d. 21 years

7. More reliable and superior type of evidence is

- a. Oral evidence
- b. Documentary evidence
- c. Circumstantial evidence
- d. False evidence

8. In dowry death cases, the autopsy is conducted under

- a. CrPC 174
- b. CrPC 176
- c. IPC 176
- d. CrPC 142

9. Section IEA for expert witness is

- a. 39 c. 45
b. 56 d. 60

10. Leading questions are not allowed in

- a. Cross examination
b. Re-cross examination

c. Hostile witness in examination in chief
d. Examination in chief

Answer key

1. b	2. d	3. a	4. c	5. d
6. b	7. a	8. b	9. c	10. d

Learning Objectives

- Describe the types of courts and their powers.
- Describe Inquest, Evidence, Witness, Summons, Conduct money and Record of evidence in the Court of Law.
- Describe the conduct of a medical professional in the Court of Law.

Important SAQ

- Explain various courts and their powers.
- Write on different types of inquest.
- Write a note on types of witness.
- Explain summons.
- Write a short note on recording of evidence.
- Explain conduct money.

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Personal Identity

18.1 Identification Data

Identification

It is the determination of individuality of a person, either living or dead.

It is of **two types** –

- ❖ Complete or absolute identification: There is 100% surety about the individuality of the person, or no doubt regarding the identity of the person. It is usually done by police.
- ❖ Partial identification or In-complete identification: There is less than 100% surety about the identification or there is still doubt regarding the identity of the person. There are only certain features like race, sex, age, stature are know etc. This is usually the duty of a forensic expert.

Data used in Identification

- ❖ Big four parameters: (1) age, (2) sex, (3) stature and (4) race
- ❖ Forensic:
 - Osteology (bones)
 - Odontology (teeth and bite marks)
 - Trichology (hair)
- ❖ Prints:
 - Finger printing

- DNA finger printing
- Other prints like lip prints (cheiloscopsy), palatoprints, footprints

Others

- Tattoo marks
- Moles
- Scars
- Birth marks
- Deformities
- Anthropometry
- Superimposition
- Religion

Need of Identification

1. **In living persons:** It is done usually by police in cases of impersonation, identification in court of law, mix up of new born babies in hospitals and absconding soldiers and criminals.
2. **Dead persons:** It is done recently dead persons, decomposed body on and burnt or mutilated bodies.
3. **In civil cases:** It is done on insurance, pension, disputed sex, marriage and missing person.
4. **Criminal cases:** It is done in case of assault, murder and rape.

18.2 Age

Age can be determined in

1. Intrauterine life
2. Adults (0-25 years and above 25 years)

Factors helps in Age estimations

1. Teeth
2. Appearance and fusion of ossification centers
3. Secondary sexual characters
4. Age related changes

Age estimation in Intrauterine life done by

1. Month wise development
2. Rule of Hasse
3. Closure of fontanelle

1. Month-wise Development

- ❖ **First month:** Length is 1cm. Eyes are seen as dark spots, mouth is as cleft.
- ❖ **Second month:** Length is 4cm, hands and feet are webbed, anus is seen as dark spots.
- ❖ **Third month:** Length will be 9cm, pupillary membranes appear, nails appear.
- ❖ **Fourth month:** Length is 16cm, sex can be recognised, Lanugo hairs appear, meconium is seen in the duodenum, tooth gums develop in the alveolar cavities of jaws.
- ❖ **Fifth month:** Length will be 25cm, light hairs appear on the head, skin is covered with vernix caseosa, meconium is seen at the beginning of large intestine, ossification centre present in the calcaneum and manubrium sternum.
- ❖ **Sixth month:** Length is 30cm, eyebrows and eye lashes appear, testicles are seen close to the kidney, ossification centre for first piece of sternum.
- ❖ **Seventh month:** Length is 35cm, eyelids open and pupillary membrane disappears, meconium is seen at the

entire large intestine, testicles are seen at the externalinguinal ring.

- ❖ **Eighth month:** Length is 40cm, nails reach at the tip of the fingers, left testicle is present in the scrotum, ossification centre in the 3rd piece of sternum.
- ❖ **Ninth month:** Length is 45cm, meconium is present at the end of large intestine, both testicles present in the scrotum by the end of 9th month, ossification centres are present in the cuboid, lower end of femur, fourth piece of sternum.
- ❖ **Tenth month (full term baby):** Length is 50cm, head circumference is 33cm, lanugo hairs absent except on the shoulders, the nail project beyond the finger tips but only reach at the tip of toe, ossification centres for the upper end of tibia may appear just before birth, tooth germ (embryonic cells of tooth) of the entire temporary and first permanent molar will be present.

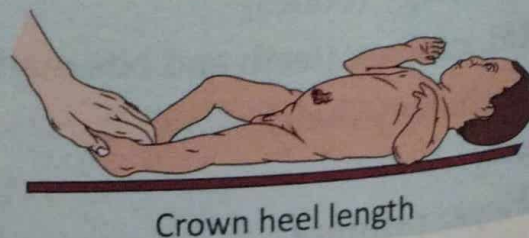
2. Rule of Hasse

Intrauterine age can be determined from the crown heel length of the foetus. Length is measured in cm and age obtained is in months. Up to 25cm square root of the length, if it is more than 25cm the length should be divided by the number 5.

IU age of Foetus in month

Rule of Hasse

First 5 months of pregnancy	Last 5 months of pregnancy
Age in months = Square root of crown heel length (in cm)	Age in months = crown heel length (in cm) divided by 5

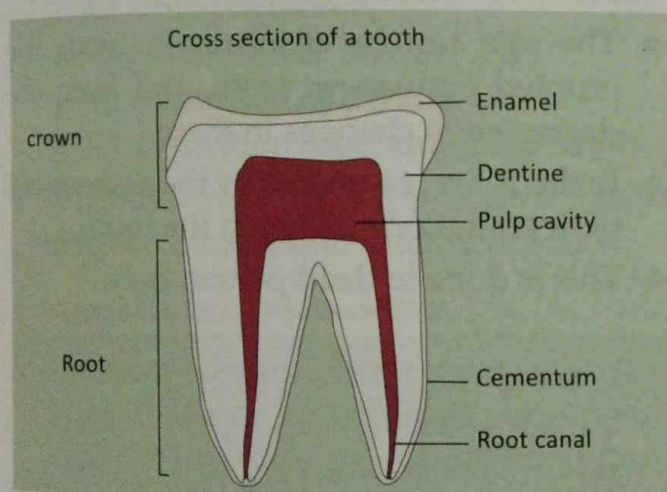


3. Age of Closure of fontanelle

1. **Posterior fontanelle (lambda):** It will be closed within 1-3 months after birth.
2. **Antero-lateral and postero lateral:** fontanelle (sphenoidal and mastoidal) will be closed in 3-6 months.
3. **Anterior fontanelle (bregma):** It will be closed in 18-24 months.

Teeth

- ❖ In a young individual, age can be estimated by the eruption status of the teeth.
- ❖ Development of tooth begins with the formation of cellular tooth germ in the alveolar bones in the shape of the crown.
- ❖ At birth, rudiments of all temporary and first permanent molar tooth may be found in the jaws.
- ❖ Root formation is completed sometimes after the eruption of crown.



Dentition

There are two dentitions in human's life

1. Temporary dentition
2. Permanent dentition

There is a period of mixed dentition possessing few temporary and few permanent teeth.

Temporary tooth (deciduous tooth)

- ❖ Temporary, deciduous or milk teeth are 20 in number. 2102 is the dental formula

of one quadrant of teeth. That is in each jaw, 4 incisors, 2 canines and 4 molar teeth are present.

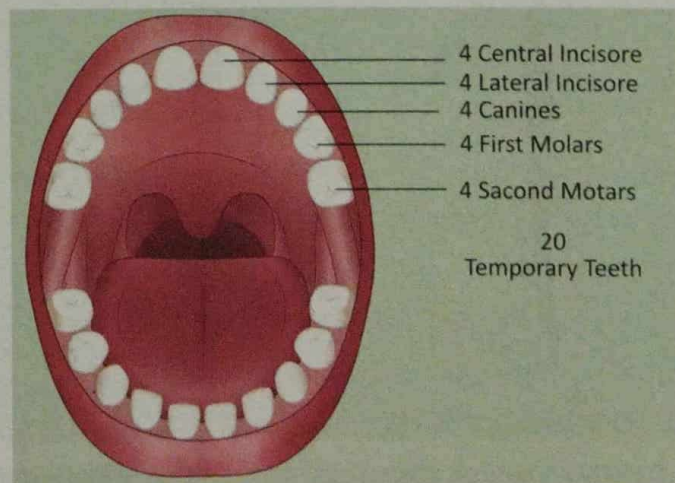
- ❖ The ill-nourished children, especially in rickets and hypothyroidism, dentition may be delayed.
- ❖ In congenital syphilis, the eruption may be premature or even present at birth.
- ❖ In normal child, the temporary teeth will eruption between 6 months and 2.5 years.
- ❖ The primary dentition will be completed by 2-2.5 years.

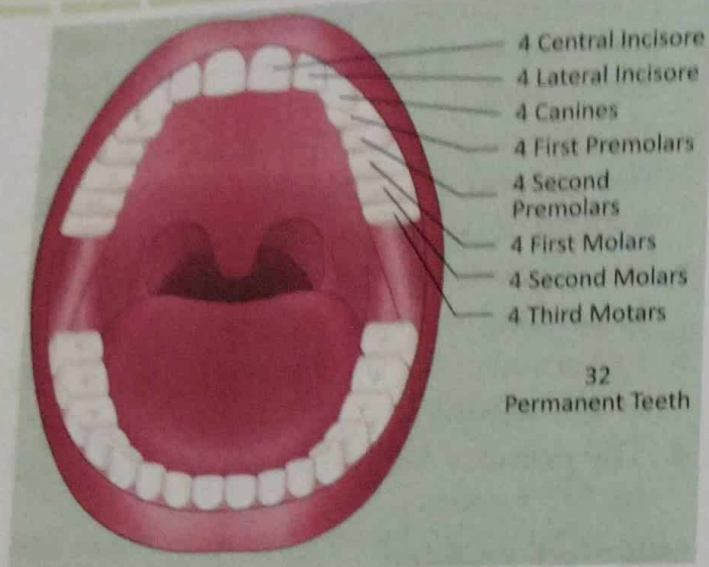
Milk teeth eruption

Medial incisors	5-6 months 6-7 months
Lateral incisors	7-8 months 8-9 months
First molars	1 year
Canines	1.5 years
Second molars	2-2.5 years

Period of eruption of permanent teeth

First permanent molar	6-7 years
Medial incisors	7-8 years
Lateral incisors	8-9 years
First premolar	9-10 years
Second premolar	10-11 years
Canines	11-12 years
Second molars	12-14 years
Third molars	17-25 years





Differences between milk teeth and permanent teeth

Milk teeth	Permanent teeth
Small light and narrow	Larger, heavier, broader
Milky white in colour	Ivory white in colour
Smooth cutting edge	Irregularities at cutting edge
Tooth germ beneath the X-ray	No tooth germ beneath
Neck is constricted	No constriction
Vertically placed	Inclined forwards

Milk teeth

A ridge or thick edge present at junction, of the crown and root

Root of molar are smaller and more divergent

Permanent teeth

No ridge present

Roots are bigger and less divergent

Period of mixed dentition

- ❖ This starts from the eruption of first molar. It is usually 6-11 years and may extend up to 12-13 years.
- ❖ Number of teeth at 2-6 years: 20 temporary.
- ❖ Number of teeth at 7 years: 24 teeth, 4 permanent and 20 temporary teeth.
- ❖ At the age of 10 years: 16 permanent teeth & 8 temporary teeth.
- ❖ At 11 years: 20 permanent teeth & 4 temporary teeth.

Gustafson's method

- ❖ The age can be determined from the erupted permanent teeth, and from the degradation changes in them.
- ❖ In this is age, estimated by the assessment of degradation change in the tooth.
- ❖ This is done in dead person only.

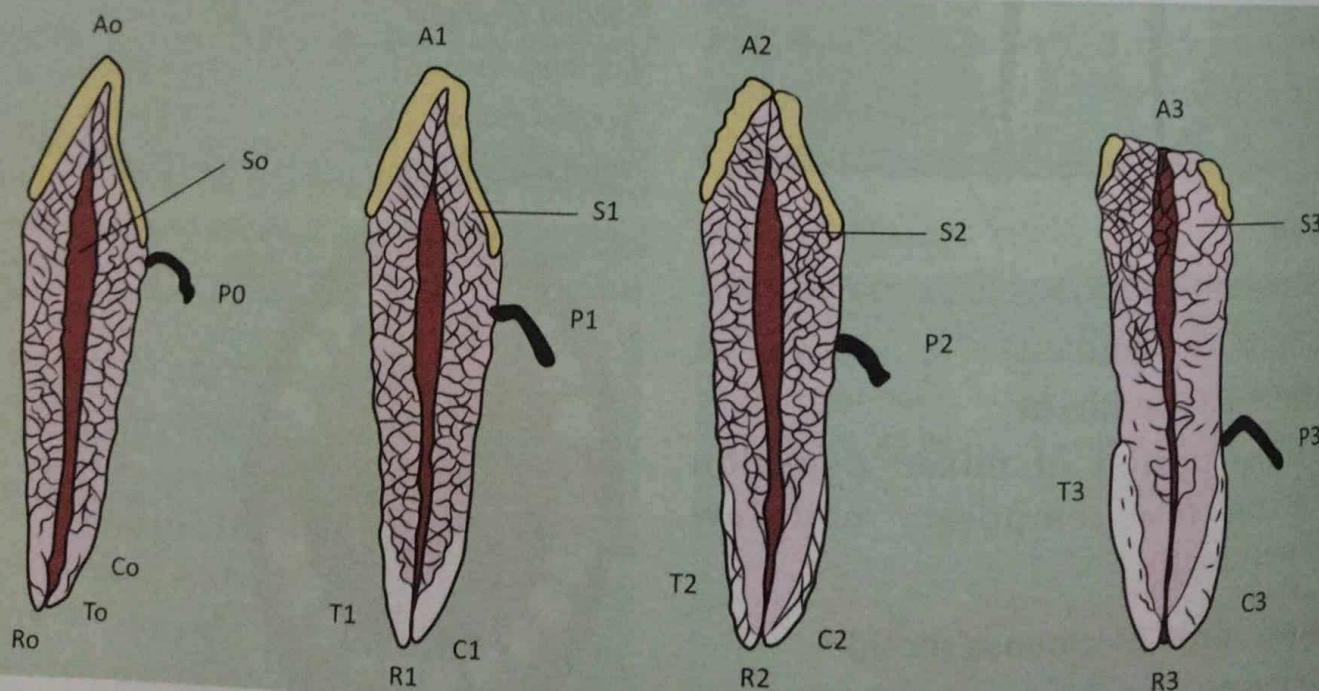


Fig: Gustafson's method

- ❖ Longitudinal section of the tooth is examined through microscope and through naked eye for the evidence of attrition, parodontosis, secondary dentine, cementum apposition, root resorption and root transparency.
- ❖ Before the tooth is extracted, the root resorption is extracted.
- ❖ Usually incisors or canines on the upper jaw are preferred for this method.
- ❖ Molars are not suitable.
- ❖ Most useful in the age between 25-60 years.

1. Attrition

- ❖ This is the wear and tear of teeth from mastication, the occlusal surface of the tooth is destroyed gradually.
- ❖ Attrition occurs first to the enamel, then dentine and lastly to the pulp cavity.
 - A0 = No attrition
 - A1 = Attrition of enamel
 - A2 = Attrition of dentine
 - A3 = Attrition involving pulp cavity
- ❖ Attrition can be appreciated both macroscopically and microscopically.

2. Parodontosis/periodontosis

- ❖ Retraction of gum margin and loosening of tooth due to regression of periodontal tissues surrounding the tooth take place, as age advances.
- ❖ Gradually the neck and root of the tooth is exposed and finally, it falls off. Poor oral hygiene facilitates this to happen.
 - P0 = No regression of gum margin
 - P1 = Parodontosis has just begun
 - P2 = Regression has passed 1/3 of the root
 - P3 = Regression has passed, 2/3 of the root
- ❖ It can be assessed macroscopically before the extraction of the tooth.

3. Secondary dentine

- ❖ The secondary dentine will be deposited on the walls of pulp cavity as age advances, this is graded as
 - S0 = No secondary dentine is visible
 - S1 = Secondary dentine has just began to form
 - S2 = The pulp cavity is half-filled
 - S3 = The pulp cavity is almost filled

These changes can be best seen microscopically.

4. Cementum apposition

- ❖ Secondary cementum is slowly and continuously deposited around the roots as the age advances, this is graded as–
 - C0 = No secondary cementum
 - C1 = A few layers of cementum
 - C2 = Greater layers of cementum
 - C3 = A heavy layer of cementum
 This is better visible microscopically.

5. Root resorption

- ❖ The root is gradually degraded and reduced in length and width–
 - R0 = no visible root resorption
 - R1 = some degree of resorption
 - R2 = greater loss of substance
 - R3 = greater loss of cementum and dentine and the root becomes narrow and short
- ❖ This is better seen microscopically.

6. Root transparency

- ❖ The root becomes more and more transparent as the age advances. This can be graded as:
 - T0 = Root is not transparent
 - T1 = Just seen at the end of the root
 - T2 = 1/3 of the tooth is transparent
 - T3 = 2/3 of the tooth is transparent

Root transparency is the most reliable criteria

Incremental lines: (Boyde's method)

In developing teeth, it is claimed that the deposition of dentine and enamel take place by layers after the formation of neonatal lines. It is seen in the temporary and permanent dentition microscopically as cross striations. These are called incremental lines.

This method of age estimation is called **Boyde's method**.

Forensic Odontology

- ❖ It is the medicolegal aspects of dentistry.
- ❖ Dental knowledge is applied in the investigation of the crime and administration of justice.

Scope- dental studies

In forensic odontology, peculiarities of teeth are studied like, pattern of teeth, teeth alignment, artificial teeth, crowned teeth, crowned tooth, dental fillings and dentures.

1. Identification of unknown dead body:
This is done in comparing antemortem and postmortem records or DNA study of tooth pulp.
2. Identification of burnt, mutilated or decomposing remains (as teeth are very resistant to decomposing or destructive process).
3. Estimation of age on the basis of eruption status as per Gustafson's method.
4. Identification of race, occupation and sex by studying characteristic features.
5. Identification of culprit through bite marks.
6. Diagnosis of poisoning: E.g. lead poisoning leaves behind a bluish line on the gingival margin.

Human bite marks

- ❖ Human bite marks are semicircular or crescentic shape caused by the front teeth mainly incisors and canines.
- ❖ They are patterned abrasions or contusions or even laceration depending on the pressure of the bite.
- ❖ Bite marks are commonly seen in situations like assaults, sexual assaults (love bites) and in child abuse cases. Bite marks are also obtained from food stuffs like apple, cheese, chocolates, etc.
- ❖ Method of development: The bite mark on the body is photographed from different angles.
- ❖ Cast can be made from the teeth of suspected individuals and impressions are made on transparent paper. This is superimposed on the transparent photograph of the bite mark and points of concordance are taken as positive identification.
- ❖ The suspected person is asked to bite cheese or similar material and photographic transparency of the bite mark is prepared. This is superimposed on the transparent photo of the bite mark on the body.
- ❖ Now there are advanced comparison methods like 3D scanning, laser imaging and bite map imaging.
- ❖ In a living person, healing bite mark can be visualised by UV or IR light.
- ❖ In case of fresh bite marks, after taking photographs and swabs are taken for saliva sample for analysis. Skin containing bite mark are also cut out during autopsy and preserved in formalin.
- ❖ Blood grouping and DNA analysis can be done from the salivary epithelial cells in the swab.

Appearance and Fusion of Ossification Centres

Development and growth of bones take place by various methods of ossification. The process of appearance and union of ossification centres follows a definitive time sequence which can be utilised for age estimation.

One of the best methods of age estimation is undoubtedly the radiological survey of ossification status of various bones.

In young children, the radiological examination of hand and foot alone can be sufficient for fixation accurate of age.

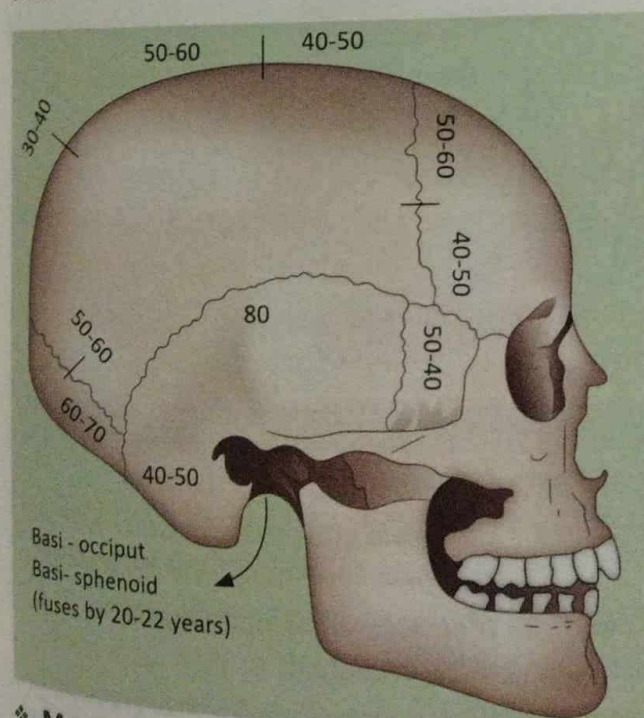
Clavicle is the first bone to ossify in the body by membranous ossification in 5th-6th week.

All the primary ossification (first area of bone to start ossifying) centres appear by 3rd intrauterine life, others are secondary ossification centres.

At birth, there are 450 ossification centres.

Closure of the sutures of the skull gives an approximate age of the individual.

Skull



Metopic suture: 2-8 years

❖ Basal suture

- Females: 18-22 years
- Males: 19-24 years

❖ Sagittal suture

- Posterior 1/3rd: 30-40 years
- Anterior 1/3rd: 40-50 years
- Middle 1/3rd: 50-60 years

❖ Coronal suture

- Lower half: 40-50 years
- Upper half: 50-60 years

❖ Lambdoid suture

- Upper: 50-60 years
- Lower: 60-70 years

❖ Temporal suture: 80 years

Appearance and Fusion of various joints

Joint	Appearance	Fusion
Shoulder joint		
Upper end of Humerus	1-6 years	16-18 years
Acromial end	14 years	17-18 years
Coracoid process	10 years	16 years
Elbow joint		
Lower end of Humerus	2-8 years	14-17 years
Upper end of radius	6 years	14-17 years
Upper end of ulna	10 years	14-17 years
Wrist joint	2-11 years	16-18 years
Pelvis		
Iliac crest	14 years	18 years
Ischial tuberosity	16 years	19 years in females & 21 years in males
Femur	1-11 years	15-17 years

Fusion of centres of sternum

❖ Xiphi sternum fuses with the body: At 40 years.

❖ Manubrium sternum: Above 50 years–

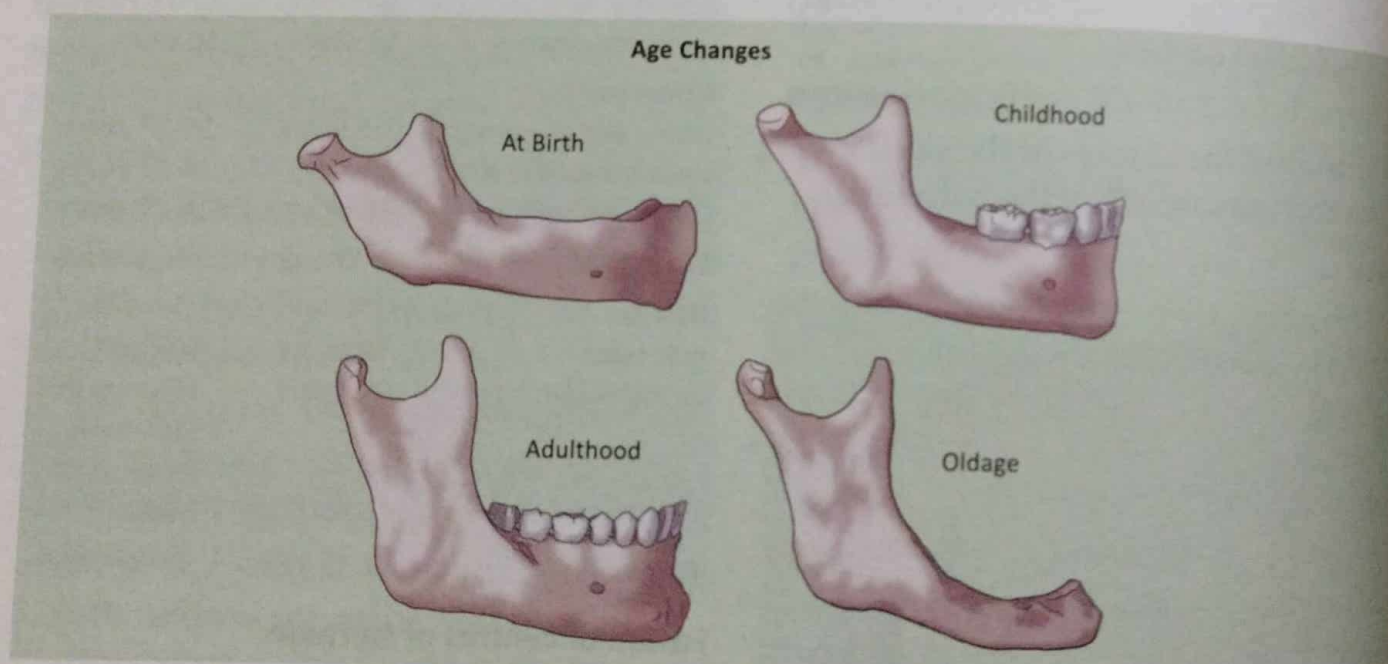
- Thyroid and hyoid bone ossifies between 35-45 years.
- Sacrum fuses from below upwards and fusion becomes completed in 20-25 years.

Age Changes at Pubic Symphysis

- ❖ Age changes in the pubic symphysis is the best criteria during 3rd – 5th decade.
- ❖ At the age of 20 – horizontal ridging of bone appears from ventral surface to dorsal surface: called as Billowing.
- ❖ Billowing gradually disappears.
- ❖ At about 25-35 years, the surface becomes granular and a rim formation starts.
- ❖ At about 35-45 years, upper and lower end rise, called lipping.
- ❖ At about 45-55 years, margins start breaking of rims.
- ❖ At 55-65 years, breaking of the margins almost complete and granularity is seen.



Age changes in the mandible bone



Child	Adult	Old age
Body of mandible is shallow	Body of mandible is thick and long	Body of mandible is shallow.
Condyloid process is at a lower level than coronoid process.	Condyloid process project above the coronoid process.	Condyloid process bends backwards and at a lower level than coronoid process.
Mental foramen opens near the margin	Mental foramen opens midway between upper and lower margins.	Mental foramen opens near the alveolar margin.
Ramus is short and makes an obtuse angle with the body.	Ramus makes less obtuse angle with the body.	Ramus makes an obtuse angle with the body.

Development of Secondary Sexual Characters

In Males

- ❖ First sign of puberty in boys is the increase in the size of testicles: GONADARCHÉ at 13 years.
- ❖ Pubarche – brownish pubic hairs start appearing.
- ❖ Enlargement of penis occurs.
- ❖ At 15 years, axillary hairs begin to appear.
- ❖ At 16 years, pubic hairs become dark and thick, facial hairs start appearing.
- ❖ At 16 years, voice becomes hoarse.

In Females

- ❖ First sign of puberty in girls is the development of breast (Thelarche) at 10–13 years.
- ❖ After few months appearance of brown pubic hairs occurs.
- ❖ At about 15 years – axillary hairs appear.
- ❖ First menstruation starts (Menarche) – at 13 years.
- ❖ At 15 years – pubic hairs grow and become black.

In Older age (age related changes)

- ❖ At about 40 years: greying of hairs appears, baldness starts (variable).
- ❖ Arcus senilis: Opaque zone appears around the periphery of the cornea due to deposition of lipids.
- ❖ Greying of pubic hairs: 50–55 years.

Medicolegal Significance of Age

A. Criminal responsibility

- ❖ According to 82 IPC: A person below 7 years is not criminally responsible.
- ❖ According to 83 IPC: A person above 7 years and below 12 years is criminally responsible if he understands the nature and consequences of the act.

- ❖ So from this, it is evident that the person above 12 years is definitely criminally responsible.

B. Consent

- ❖ According to 89 IPC: A child below 12 years or mentally ill cannot give a valid consent.
- ❖ According to 87 IPC: A person above 18 years can give a valid consent to suffer any harm known to cause death or grievous hurt; e.g. dangerous games, sports like boxing, hill climbing, and karate.
- ❖ According to 88 IPC: Nothing is an offence which is done in good faith and the valid consent to suffer any harm. E.g. major surgical operations.

C. Judicial punishment

- ❖ According to Juvenile Justice Act, juvenile is a person under the age of 18 years.
- ❖ If juvenile commits a crime, she/he may be sent to juvenile homes or special homes established by the govt.

D. Rape

- ❖ Sexual intercourse by a man with a girl below 15 years even if she is his wife or any other girl who is under 18 years even with her consent is rape. (IPC 375 amendment act 2013).
- ❖ In India, importing a foreign national for illicit intercourse is an offence, if her age is below 21 years.

E. Kidnapping

- ❖ According to 369 IPC: It is an offence to kidnap a minor for the purpose of taking dishonestly any movable property if the age is below 10 years.
- ❖ According to 361, 363 IPC: It is an offence to kidnap a minor from lawful guardianship if the age of the boy is below 16 years, and the age of the girl is below 18 years.

- ❖ According to 366 IPC: Importation of a girl from foreign countries (including Jammu & Kashmir) for the purpose of illicit intercourse is punishable if she is below 21 years.

F. Attainment of Majority

- ❖ In India, attainment of majority happens at 18 years.
- ❖ A person under legal guardianship attains majority at 21 years.
- ❖ A person above 18 years can cast vote in election.
- ❖ A person can work in factory after 18 years.
- ❖ After 18 years – the person can make valid will and transaction.
- ❖ After 18 years, a person can join Govt. job and get driving licence.
- ❖ A person below 18 years cannot donate his organs (Thoa Act 1994)

G. Employment

According to Factory Act (1948) and Child Labour Act–

- ❖ A child below 14 years cannot be employed in factory jobs.
- ❖ 14-15 years: can do non-hazardous jobs in the factory.
- ❖ 15 years above – can be employed if provided with a certificate.

H. Marriage contract

- ❖ For marriage, the eligible age of the boy is 21 years, and for girls it is 18 years.
- ❖ According to Child Marriage Restrain Act marriage below the eligible age of is punishable.

I. Infanticide

- ❖ A charge of infanticide can be supported only if the foetus has attained 7 months of intrauterine life.

Medicolegal Significance of various Age

7 months of Intra-uterine life /viability	Infanticide	IPC 300, IPC 302 (punishment)
1 year	Infanticide	IPC 300, IPC 302 (punishment)
Below 7 years	Not Criminal responsibility	IPC 82
Age 7-12	Criminal responsibility present , if sufficient maturity regarding the crime present	IPC 83
12 years	• Consent for physical examination • Criminal responsibility present • Oath can be taken in court	IPC 89 IPC 83
14 years above	Can be employed	Factory Act
15 years	Intercourse between husband and wife is not rape Supreme court increased the age to 18	IPC 375
16 years	Kidnaping a minor boy	IPC 361
18 years	• Attainment of majority • Age of voting • Consent for major surgery • Can donate organs • Kidnaping a minor girl • Rape – even with consent • Juvenile offender	
21 years	• Importation of foreign girl for illicit intercourse • Age of marriage for boys • Attains majority under court guardianship	

18.3 Race, Religion and Sex

Race

- ❖ Race is an important factor in identification.
- ❖ It is a biological grouping within the human species classified according to genetically transmitted traits.
- ❖ Major groups: Caucasian (white people), Negro and Mongolian.
- ❖ Indians are a mixture of and Races, Cacasoids (e.g. Kashmiris), Negroids (e.g. South Indians), Mongoloids (north eastern people)
- ❖ Race can be determined by –
 - General features
 - Skeleton
 - Dentition

Race from General features

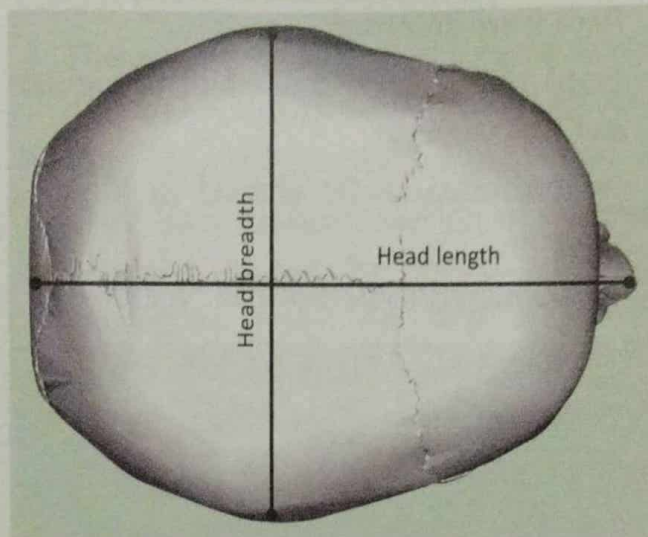
Features	Caucasians	Mongolians	Negroes
Skin	white people	yellow or brown	black
Hair colour	light golden brown	black or dark brown	Black
Hair texture	wavy	straight	curly/spiral
Hair cross section	oval	Round (Indians too)	flat/kidney
Eyes/Iris colour	Blue or grey	Black brown	Black
Nose	Narrow and long	Medium	Broad

1. Race from skeleton

Most significant in skull, mandible and long bones.

❖ Cephalic index

$$\text{Cephalic index} = \frac{\text{Maximum breadth of the skull} \times 100}{\text{Maximum length of the skull}}$$



$$\text{Cephalic index} = \frac{\text{Head breadth}}{\text{Head length}} \times 100$$

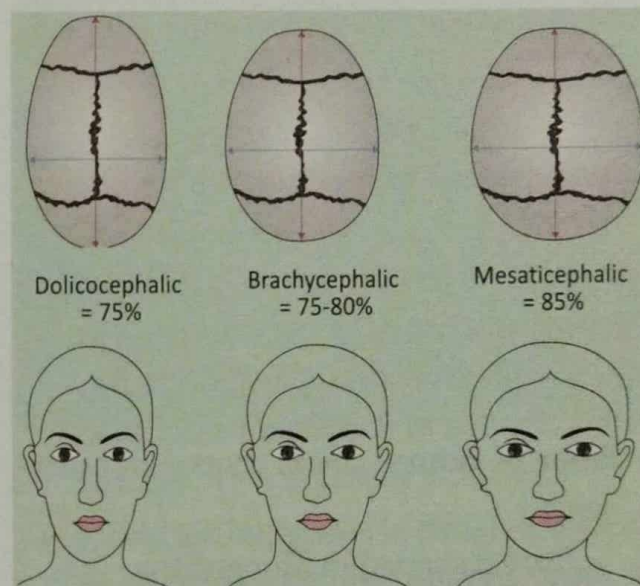


Fig: Cephalic index

Dolicocephalic	Long headed (70-75%)	Negroes, aborigines, Aryans
Brachycephalic	Medium headed (75-80%)	Caucasoids, Indians
Mesaticephalic	Short headed (80-85%)	Mongolians, Chinese

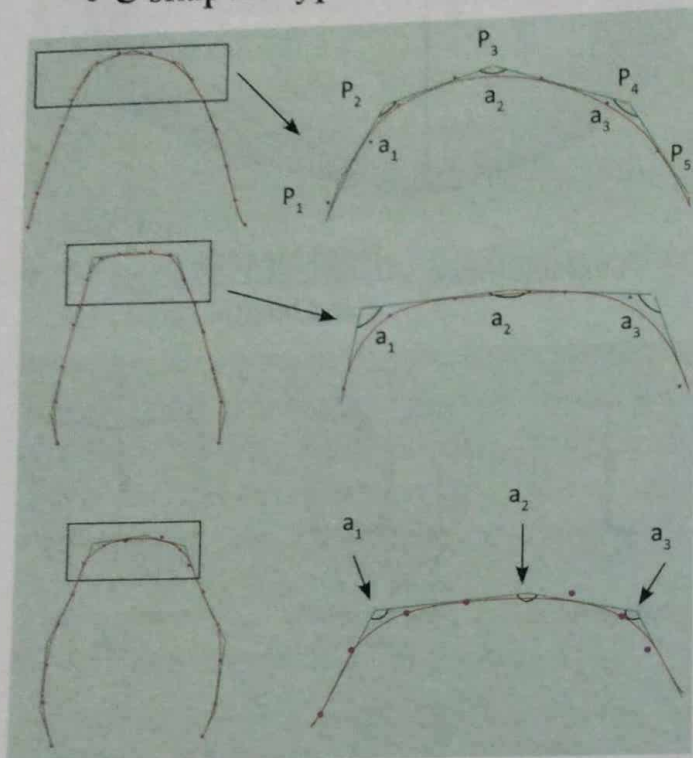
Other indices

- ❖ **Brachial index** = Length of Radius / length of Humerus X100
- ❖ **Crural index** = L of Tibia / L of Femur X100
- ❖ **Humero-femoral index** = L of Humerus / L of Femur X100
- ❖ **InterMembral index** = L. of Humerus + Radius / L. of Femur + Tibia X100

2. Race from dentition

❖ Hard palate is: 'V' shaped or triangular in Caucasians :

- Round/parabolic shaped in Mongolians
- U shaped/hyperbolic in Negroes



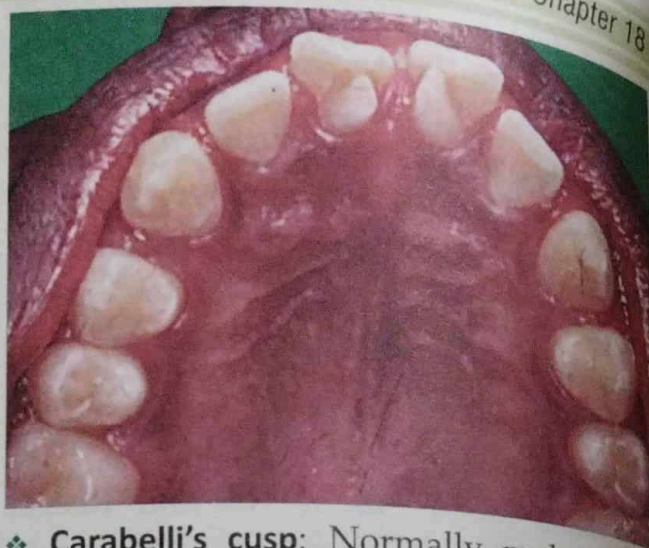
❖ **Shape of incisors:** Chisel shaped in caucasoids

- Shovel shaped in Mongolians

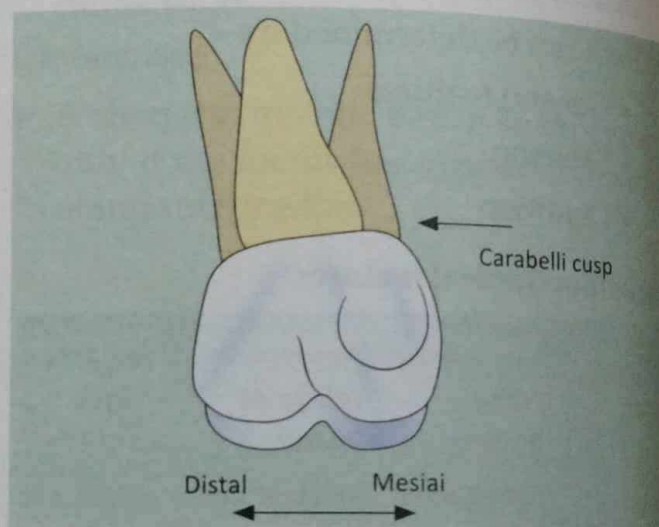


- Shovel shaped teeth

❖ **Talons cusp (eagles Talon):** Nail like projections from the neck of the incisors seen in Asians, Arabic and Native Americans.



❖ **Carabelli's cusp:** Normally molar teeth have 4 cusps and an extra or 5th cusp, called Carabelli cusp.



Sex Determination - Identification

Situation where Sex determination needed

1. For the purpose of simple identification in living, for the individual carrying features of opposite sexes.
2. When a person has primary sex organs of both sexes.
3. Civil rights: Whether the person is eligible for civil rights of a particular sex.
4. In the questions of legitimacy, divorce, paternity, affiliation and in some criminal cases.
5. Simple sex determination in dead where primary sex organs are decayed.
6. Impotence and in Rape cases.

In a normal individual, sex determination is easy by physical examination. But it is very difficult in cases of intersex and mutilated body parts in which sex organs are absent.

Intersex

1. Gonadal agenesis
2. Gonadal Dysgenesis
3. True Hermaphroditism
4. Pseudo-hermaphroditism

1. **Gonadal Agenesis:** In this condition, testis and ovary never develop. This is a rare condition.

2. **Gonadal Dysgenesis:** In this condition, external sexual characters are present, but primary sex organs testis or ovaries fail to develop.

• **Examples:** Klinefelter's (47XXY) and Turner's syndrome (45X0)

See the fig Next page

3. **True Hermaphrodites:** This is a very rare condition in which an ovary on the side and testis on the other side or ovotestis present on both sides and the external genitalia of both sexes. The gonad may be abdominal, inguinal or labio scrotal in position. There may be uterus, the phallus is penile or clitoral. Neither gonads is completely functional. The nuclear sexing is either (XX-female) or (XY-male).

4. **Pseudo Hermaphroditism:** In this condition, gonadal tissue of only one sex is seen internally, but the external appearance is that of the opposite sex.

Male Pseudohermaphroditism

- ❖ In this the nuclear sexing is XY, they are gonadal males. The external appearance is that of female in childhood.
- ❖ Testis are situated in the abdominal cavity or inguinal canal, the phallus is small or large or labial fusion is varied.
- ❖ Testicles are nearly normal but no spermatogenesis occur.

Female Pseudohermaphroditism

- ❖ These persons have sex chromosomes pattern XX and they are gonadal females.
- ❖ They have uterus, ovaries and tubes.
- ❖ They have masculinisation of external genitalia caused by raised levels of androgens (may be due to CAH-Congenital Adrenal Hyperplasia).
- ❖ Labia majora enlarged, and resembles a bifid scrotum but no testicles are palpated.
- ❖ At puberty, they develop female sex characters. They develop female voice, breast and no facial hairs.

Sex Chromatin or Positive Evidence of Sex

- ❖ This is done by confirming the presence of ovaries in males and testis in males and by the presence of **Barr bodies** and **Davidson's bodies**.
- ❖ Barr bodies or sex chromatin is a distinctive basophilic, intranuclear structure usually located near the inner surface of nuclear membrane of somatic cells of females. This is absent in males.
- ❖ Davidson body seen in female leukocytes as a drumstick like shaped from the nucleus. This is absent in males.

Chromatin positivity in Males and Females

Test	Male (%)	Female (%)
Barr body	0-4	20-80
Davidson's body	0	6
Fluorescent fuelgen	0-2	50-70
Quinacrine dichloride (Y)	45-80	0-4

In a decomposed body

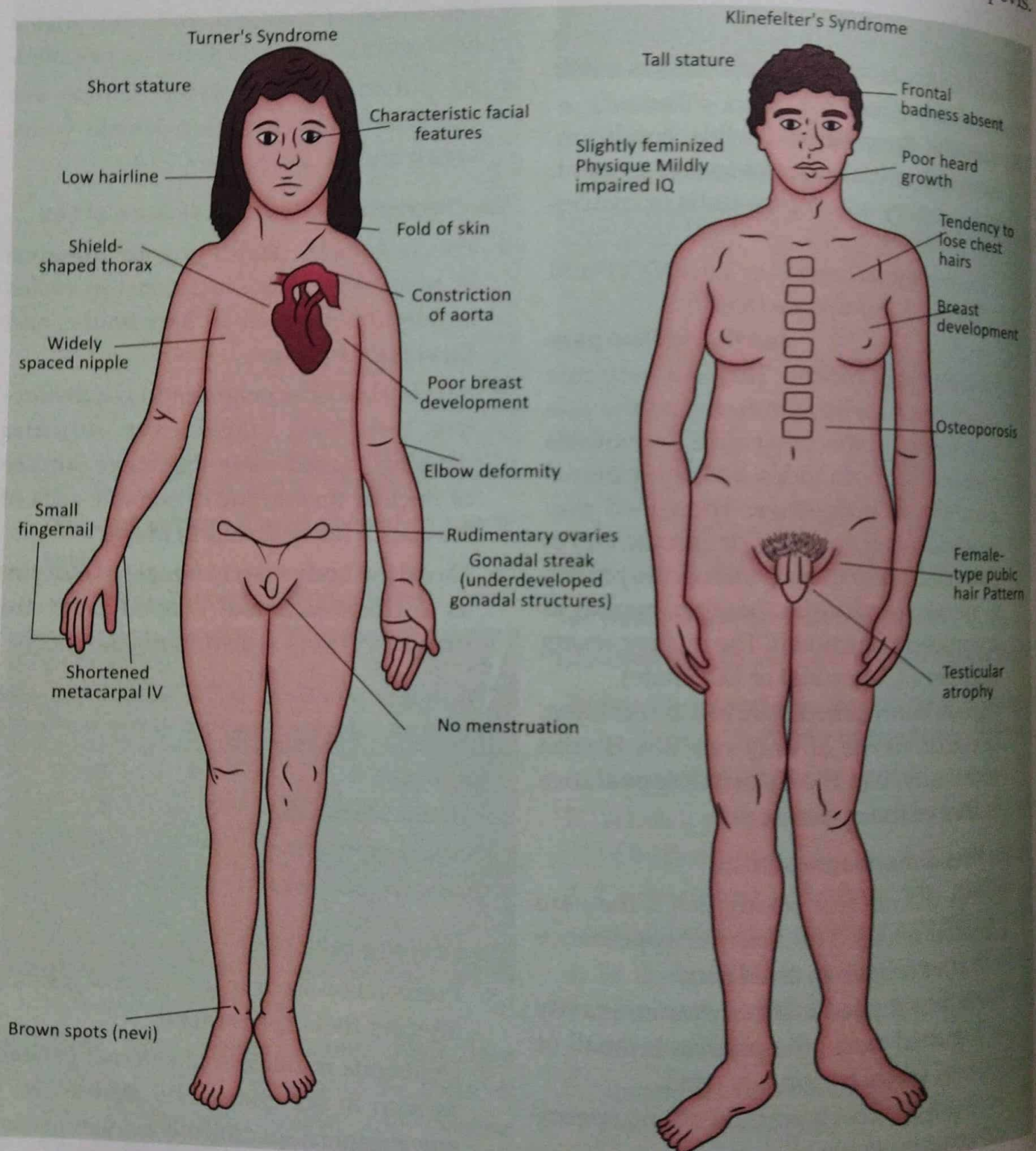
- ❖ Putrefaction starts in the external genitalia altering their appearance.
- ❖ Deliberate mutilation of external genitalia as seen in sex crimes and destruction of scavengers causes difficulty in identification.

- ❖ In such circumstances, one must make a search for the ovaries.
- ❖ A non-pregnant uterus and a uterus containing non-degenerative myomas are significantly resistant to putrefaction.
- ❖ Prostate gland is also one organ to putrefy last.

❖ But the primary sex organs are unidentifiable and one has to look for sexual characteristics in the skeleton.

Sex determination from skeleton

- ❖ Sex determination is done from the skeleton, especially by examining the skull with mandible, pelvis and long bones.
- ❖ Among all bones, the most useful is pelvis.



Krogmans criteria of determination of sex from skeleton

Degree of accuracy in sex determination	
Entire skeleton	100%
Pelvis alone	95%
Skull alone	90%
Pelvis + skull	98%
Long bones	80%
Skull + long bones	95%
Pelvis + long bones	98%

Differences between male and female mandibles

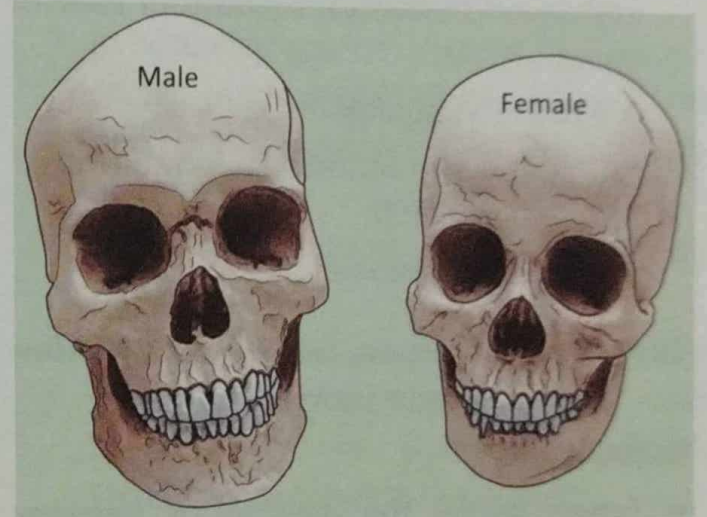
Features	Male mandible	Female mandible
Size	Larger and thicker	Smaller and thinner
Height of the body	Greater	Lesser
Angle of mandible	Everted	Inverted
Chin	Quadrilateral	Rounded
Inferior border of body of mandible	Irregular	Smooth
Condyles	Larger	Smaller

See the fig down

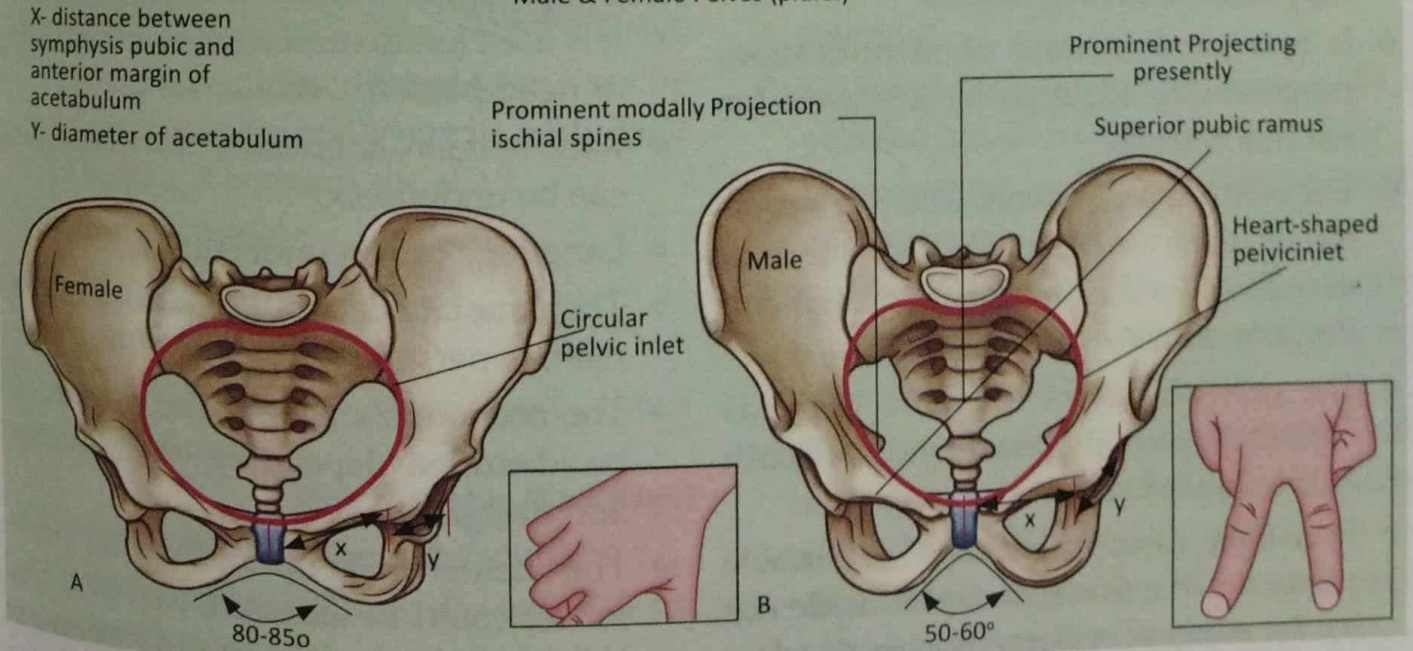
	Female Pelvis	Male Pelvis
Pelvic Inlet	Oval/round	Narrow/heart shaped
Sub pubic angle	Wide > 80 degrees	Narrow 50-60 degrees
Greater (false) pelvis	Shallow	Deep
Lesser (true) pelvis	Wide, shallow & cylindrical	Narrow, deep & tapering
X-Y ratio (acetabulum)	1 or > 1	Less than 1

Main Differences Between Male and Female Skeletons

Skull



Male & Female Pelves (plural)



- ❖ **Forehead:** Male skulls have more prominent **Glabella** and supraorbital Ridges.
- ❖ **Temple:** Male Skulls have Rounder **Orbits**.
- ❖ **Jaws:** Female **jaws** are Narrower **Frontal eminences**.

Some important measurements

- ❖ Sciatic notch index = Width of notch in mm/ depth of notch X100
 - Male: 4-5; females: 5-6
- ❖ Washburn Ischiopubic index = Pubic length (mm)/ Ischial length X100
 - Male: 73-94; female: 94-115
- ❖ Corporobasal sacral index = Breadth of first sacral vertebra/breadth of base of sacrum X100
 - Male: 45 females: 40.5
- ❖ Sternal index = Manubrial length(mm)/ body length X100
 - Male: 46.2; female: 54.3

18.4 Moles, Tattoos, Scars, Occupational Marks and Hairs

Tattoo marks

- ❖ Tattoo marks the designs or patterns imprinted on the skin surface by multiple puncture wounds with the help of needles dipped in colouring matter.
- ❖ It is a good method of identification, purposefully acquired by a person for various reasons.
- ❖ The colouring pigments which are commonly using are carbon (black), cinnabar, vermilion (red), chromic oxide (green), Prussian blue (blue).
- ❖ The permanence of the mark depends both the type of dye used, and the depth of the skin involved.
- ❖ Even faint/disappeared marks of unstable pigments like cinnabar can be made out by the study of regional lymph glands.

- ❖ When tattoo marks are not clear due to mummification and decomposition, they can be visualised by treating that area with 3% H_2O_2 which temporarily removes the materials of decomposition by oxidation.
- ❖ Tattoo marks are surgically removed by skin grafting, and also by the use of laser beams.
- ❖ A tattoo mark can be either altered or superimposed over another design subsequently.

Medicolegal Importance



- ❖ It is used for identification of either living or dead person.
- ❖ Race, religion, nationality of an individual can be understood.
- ❖ Language can be understood.
- ❖ The name tattooed could be an associated/relative person.
- ❖ The economic status of the person can be identified depending on the colour and design.
- ❖ The mental makeup and sexual preferences could be assessed, like blue bird sign on the back of the hand at the base of

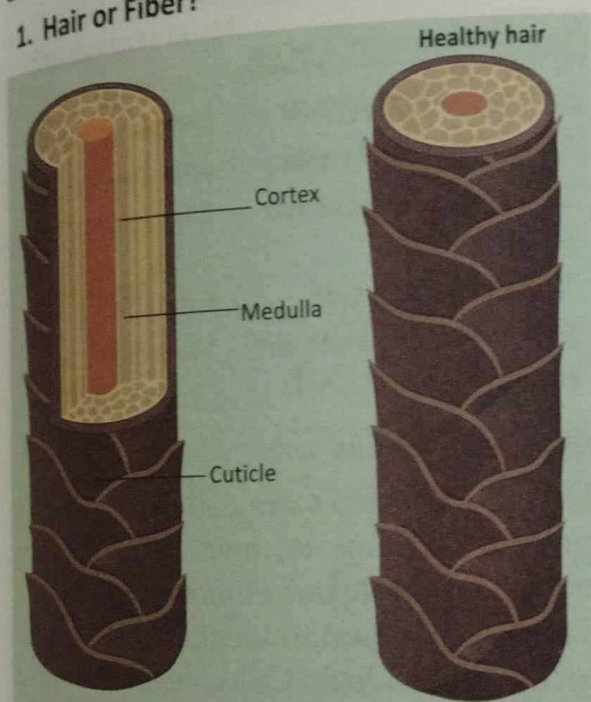
- the thumb and the forefinger is common among homosexuals.
- Dates tattooed may dates of personal events.
- Drug addicts often imprint tattoos over areas where multiple injection marks are present in order to conceal them.

Hairs in Identification

The study of hair is called Trichology. Hair remains are identifiable even in the advanced stage of decomposition.

Examination of hair is done to find out

1. Hair or Fiber?



Hair can be differentiated from fiber by microscopically analysing its parts. Hair is having 3 zones in the shaft

- Outer – cuticle
- Middle – cortex
- Inner – medulla
- Fiber usually does not have these zones.

(See the table Next page)

3. From which part of the body/source

- Scalp hairs – gradually taper from root to tip.

- Chest, axilla, pubic hairs – are short, curly and stout.
- Eyelashes, eyebrows, nostrils are: stiff, thick and tapering towards the tip.

4. **Sex:** Determined by the presence of **Barr bodies** and **Davidson bodies**.

5. **Blood groups:** ABO blood grouping of hair can be done with modified absorption elution technique with 100% accuracy.

Medicolegal importance of Hair

1. Presence of hair on the weapon or in the hands of the victim in murder cases.
2. Pubic hairs of accused on the victim in case of rape and sodomy.
3. In bestiality, animal hairs can be detected on the pubic region of the accused and presence of human hair on the genitals of animals.
4. Sex determination can be done by Barr bodies.
5. In poisoning cases, especially in heavy metal poisoning, arsenic, lead and mercury can be detected by NAA (Neutron Activation Analysis).
6. Identification of accused in hit and run in RTA cases, by the presence of hairs adhered in the vehicle especially in steering.
7. Singeing of hairs can be seen with a peculiar smell in burns not in scalds.
8. DNA analysis can be done with hair bulb and cuticular cells.
9. Stains of hair like blood, semen saliva can be subjected to DNA analysis for identification of the criminal.
10. Blood grouping can be done with absorption elution technique, even from a single hair bulb.
11. Tip of the hair is sharply cut in incised wound and crushed in blunt injuries.

2. Human hair or animal hair?

Points	Human hair	Animal hair
General	Thin and fine	Thick and coarse
Cuticular scales	Scale, thin short and flattened, and scales completely surrounds the shaft	Large and polyhedral scales and do not surround the shaft completely
Type of hair	Type 7	Other than 7
Cortex	Thick and broad	Narrow
Medulla	Thin, narrow and fragmented	Thick broad and continuous
Pigment granules	More concentrated towards cortex and cuticle	Concentrated towards medulla
Medullary index Diameter of medulla Diameter of whole shaft	Less than 0.3	Always more than 0.5
Precipitin test	Specific for humans	Specific for animals

12. Race can also be identified.
13. Dyed hair will show characteristic, fluorescence with ultra violet light.
14. In chronic malnutrition due to starvation or Kwashiorkor hair may be smoky red or showing flag sign.

Scars

- ❖ A scar is an acquired defect made of fibrous tissue covered with epithelium, which is a hypo-pigmented area not having hair follicles and sweat glands.
- ❖ It is formed by healing of a wound particularly deep affecting deep tissues/dermis.
- ❖ The size, shape or location, or more or less its permanent nature of a scar can aid in positive identification.
- ❖ It not only helps in **identification** but also provides information regarding **nature of injury and causative agent/weapon**.
- ❖ The size and shape of the scar is similar to the size and shape of the original wound, whether incised, stab or lacerated, so gets information on the weapon causing injury.
- ❖ The age of the scar gives information about time of infliction of injury.

Age changes in a scar

Reddish and tender scar	2 weeks
Pale, soft and still tender	2 months
Scar- contracted pale soft and not tender	2-6 months
Tough and contracted	6 months – 1 year
Thinning of scar white and glistening	More than 2 year

Occupation Marks

Occupation marks are callosities may be present in painters, mechanics, bakers, millers, coconut tree climbers, clerks, etc. These can be used to identify them from a group of individuals. Callosities on the dorsal aspects of both feet are seen in coconut tree climbers and callosity on the lateral aspects or right middle finger is seen on the clerk.

18.5 Handwriting, Dactylography, DNA Typing and Superimposition

Handwriting

Handwriting is a characteristic of an individual.

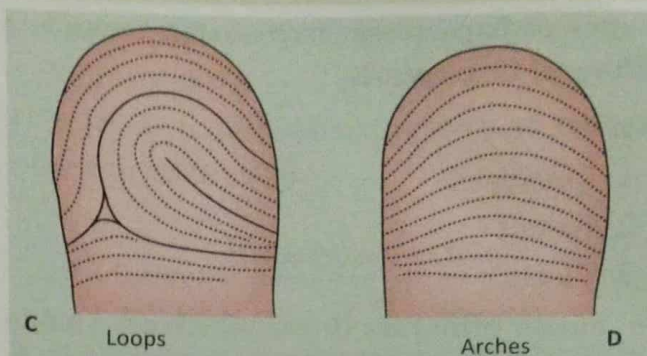
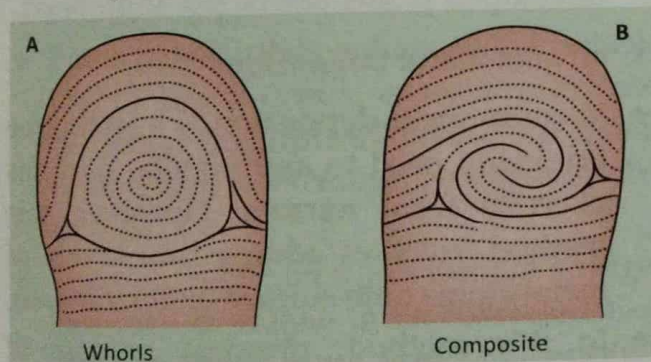
Dactylography or Galton System (Fingerprints or Dermatoglyphics)

- ❖ Fingerprints are impressions or patterns formed by papillary ridges of fingers.

- ❖ Fingerprints are considered as most reliable criteria for identification.
- ❖ Even identical twins have different fingerprints.
- ❖ This method was first used for identification by Sir William Herschel in 1877 in Hoogly district, Bengal.
- ❖ Sir Francis Galton systematised this method in 1892.
- ❖ The first fingerprint bureau in the world was established in Kolkata in 1897.
- ❖ These fingerprints are formed during 3-4 months of intrauterine life, and constant during life, unless damage occurred in the dermal layer.
- ❖ Permanent impairment of fingerprints occurred in leprosy, electrical injury, after exposure of radiation and in drykeratosis congenita.

Classification

1. Arches
2. Loops
3. Whorls
4. Composite



- ❖ **Arches:** 6-7 %
- ❖ **Loops:** 67%
- ❖ **Whorls:** 25%
- ❖ **Composite:** 1-2%

Points considered for the comparison of fingerprints

1. Ridge breaking
2. Bifurcation
3. Ridge reunion
4. Lake formation
5. Island with dot
6. Island without dot
7. Ridge ending

See the Fig Down

- The above said points are called reference points for comparison and 16- 20 similar points are considered as positive identification

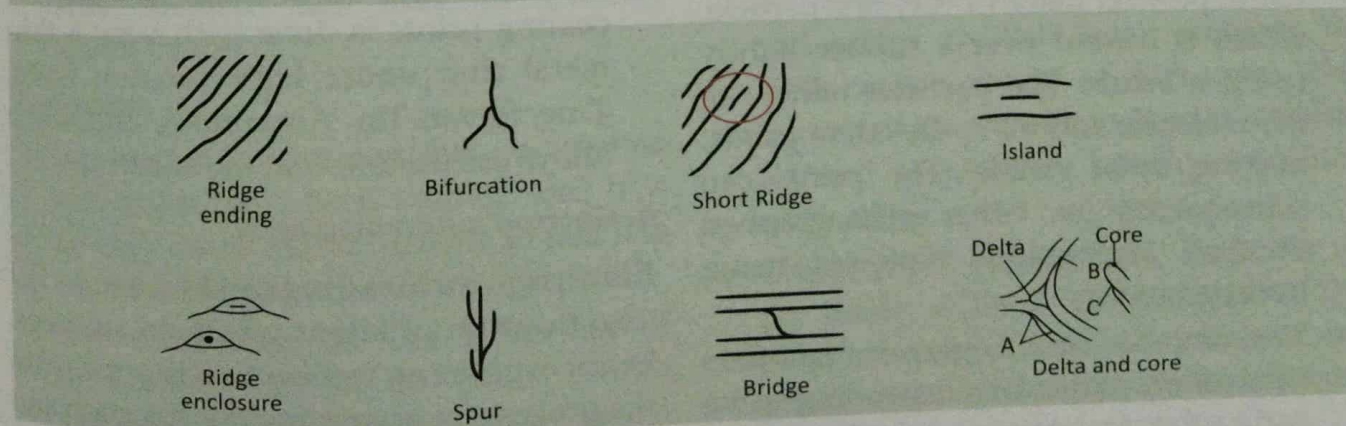


Fig: Points of comparison of fingerprint

Types of fingerprints from crime scene and lifting of fingerprints

Types

1. Patent
 2. Latent
 3. Plastic
- ❖ Patent prints are those which are visible to the naked eye. These might be prints in bloods, or by blood covered fingers, or in ink or dirt.
 - ❖ Plastic prints are somewhat similar; these are also visible to the naked eye, and are those prints that are left in a pliable substance, such as clay or wax. Both patent and plastic prints can often be recorded simply with the aid of photography, and no further work is needed (sometimes techniques may be used to enhance their visibility).
 - ❖ Latent prints (Chance prints) or invisible prints are bit complicated. They are the prints left on surfaces, due to natural oils and sweat secreted from the skin. These remain on the surface can't be seen unless something is done to make them visible.

Development of fingerprints

1. Dusting Powder

- ❖ Dusting for prints is a well-known practice and was used from 1891. It involves the use of powder made of very fine particle, which is dusted over a surface lightly using a brush. The particles adhere to the moisture and oil in the latent prints, making them visible. The prints can subsequently be either photographed or their impressions removed using transparent tape.
- ❖ The composition of **fingerprint powders** vary widely, particularly depending on the surface they are being used on. Commonly,

they consist of a **pigment** and a **binder**. The pigment helps to provide contrast, whereas the binder helps the powder to adhere to the print. Commonly used pigments are **colloidal carbon** particles, flakes of metals including **aluminium**, **zinc** and **copper**. Common binders are **gum Arabic**, **iron powder** and **rosin**. The standard black powders, fluorescent powders, which fluoresce in the presence of certain colours of light, can also be utilised.

- ❖ Commonly used powders—Grey powder (chalk + mercury) and white powder (lead carbonate)

2. Commonly using chemical developers Ninhydrin

- ❖ Ninhydrin when sprayed onto the surface, reacts with amino acids to produce the ammonium salt of Ruhemann's purple, and a clear purple colour is formed. The developed prints can be photographed.

3. Vacuum Metal Deposition (VMD)

- ❖ Vacuum metal deposition is a technique originally used to apply metal coatings glass to form mirrors. However, this method involves adding thin layers of metal atoms onto surface under vacuum.
- ❖ In this method, physical process of coating prints is done with very a thin metal film under high vacuum. Gold, Zinc, Silver, Tin, Aluminum, and some alloys are used to coat the substrate.

4. Electron autoradiography

Electron autoradiography used for visualization of latent prints on surfaces, by incorporating radioactive isotopes into the process for improving the detection and resolution of these prints.

5. Fingerprint reader (FINDER)

Automatic fingerprint reading system, reads and compares fingerprints in seconds.

Fingerprints in decomposed bodies

Skin is detached from the dead body like a glove preserved in formalin. If the print is lost, pattern is seen in the dermis also. If the fingers are dry and mummified, can be visualised by treating it with liquid paraffin or formalin injection. Also, the mummified fingers are dipped in alkali (KOH) for a considerable period making it swell to get the fingerprint.

Poroscopy

- ❖ The papillary ridges of epidermis are studded with minute pores through which sweat exudes out in living being.
- ❖ The number of these pores, as well as their size, shape, site, in a given length of ridge vary from person to person and are quite individualistic.
- ❖ Poroscopy further enhances the reliability, of latent prints, especially in case of partial fingerprints where the usual comparison of minutiae cannot be resorted to.
- ❖ There are 9-18 pores (per mm) in a ridge, and each is unique in its characteristics. This method can lead to positive identification.

Footprints

- ❖ Impressions of human feet on various substrates have been studied and it is be very much individualistic so that it is used for identification like fingerprints.
- ❖ The comparison of the footprints of the suspect with the test prints can be carried out in the same way, as in the case of fingerprints. Latent prints are

also developed in the same way like fingerprints.

- ❖ Footprints are used to understand stature of the individual.

$$\text{Stature} = \frac{\text{maximum foot length}}{0.15}$$

- ❖ It also helps to estimate the weight of the individual.
- ❖ In case of walking footprints, it is possible to relate with the gait pattern of the suspect.
- ❖ Footprints are marked by photography or by making casts.

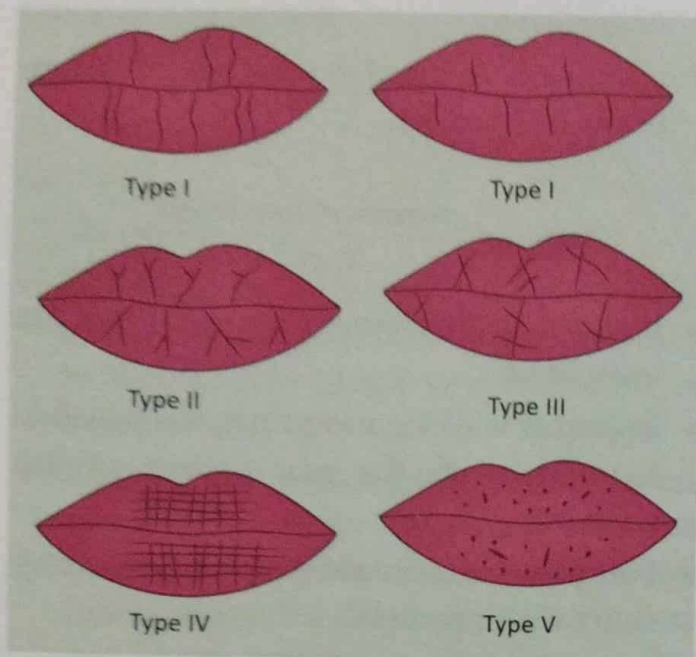
Application of Footprints

- ❖ Identification of suspect in a crime
- ❖ Footprints of infants along with thumb or index fingerprints of mothers are still commonly recorded in hospitals to assist in verifying the identity of infants.
- ❖ It is very commonly used bare foot impressions in case of military personals, and flight persons.

Cheiloscopy/Lip Prints

- ❖ Lip prints are similar to fingerprints and footprints and are also very unique and used in identification.
- ❖ The creases on the vermilion border of lips appear as white areas in lip prints, and raised reddish areas outlined by these creases appear as dark areas. The creases of the vermilion border are also referred as grooves, furrows, wrinkles and valleys.
- ❖ Cheiloscopic patterns are classified as (a) linear – lines are prominent, (b) bifurcate–bifurcation of lines are prominent and (c) reticular–lines crosses each.

Suzuki's classification of lip prints into 5



Type 1	Long vertical grooves
Type 1'	Short vertical grooves
Type 2	Branching grooves
Type 3	Intersected grooves
Type 4	Reticular grooves
Type 5	Irregular pattern

Applications

- ❖ Identification of living individual
- ❖ Identification of dead individuals
- ❖ Identification of criminal from crime scene lip prints.

DNA Fingerprinting

DNA analysis or DNA typing or DNA fingerprinting or DNA profiling is the process of determining an individual's deoxyribonucleic acid (DNA) characteristics.

Applications

It is used in crime investigation, comparing **criminal suspects'** profiles to DNA evidence so as to assess the likelihood of their involvement in the crime. It is also used in **paternity testing**, to establish **immigration eligibility**, and in **genealogical** and **medical research**. DNA profiling has also been used in the study of **animal and**

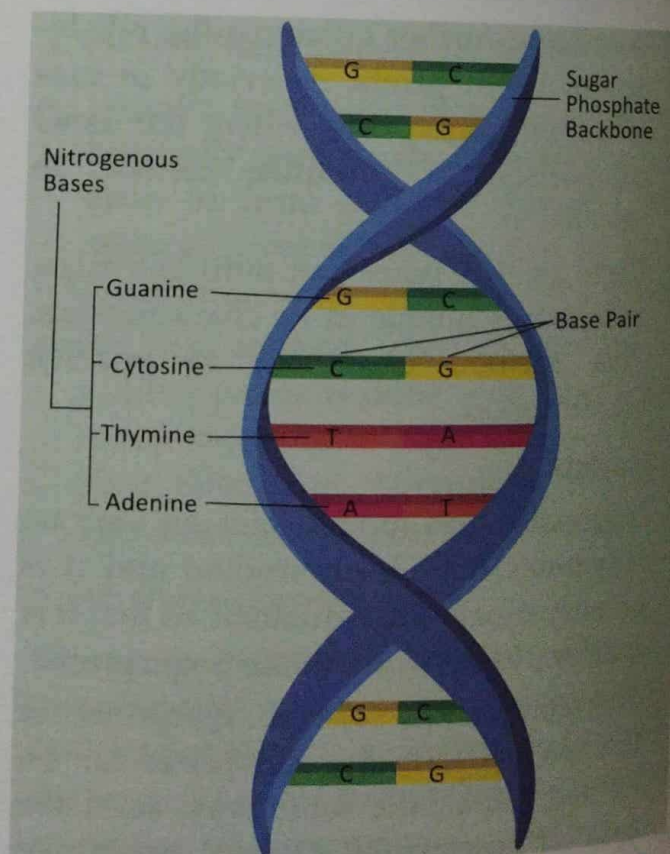
plant populations in the fields of zoology, botany and agriculture.

The technique is developed by Sir Alec Jeffreys a British Geneticist, in 1985. In 1986, it was used by him in a crime investigation of rape.

In India, this technology of evidence was accepted in the 1996 Tandoor murder case.

DNA structure

Nucleic acids are the organic materials present in all organisms in the form of DNA or RNA. These nucleic acids are formed by the combination of nitrogenous bases, sugar molecules and phosphate groups that are linked by different bonds in a series of sequences. The DNA structure defines the basic genetic makeup of our body. In fact, it defines the genetic makeup of nearly all life on earth. The sugar and phosphate groups link the nucleotides together to form each strand of DNA. Adenine (A), Thymine (T), Guanine (G) and Cytosine (C) are four types of nitrogen bases.



Various techniques of DNA fingerprinting

- ❖ **RFLP:** Restriction Fragment Length Polymorphism.
- ❖ **PCR:** Polymerase Chain Reaction
- ❖ **STR:** Short Tandem Repeats
- ❖ Mitochondrial DNA analysis

RFLP (Restriction Fragment Length Polymorphism) method of DNA fingerprinting

1. Isolation of DNA

DNA is extracted from the nucleus of any cell. The commonly used cells are blood, semen, bone, hair, buccal epithelial cells, tooth pulp and other tissues.

2. VNTR analysis

To separate variable number tandem repeats (VNTR), the double stranded DNA is cut into single strands and further cut at the junctions using the enzyme restriction endonuclease which is also known as biological scissors.

3. Electrophoresis

The pieces are separated and arranged by electrophoresis. They are arranged as bands, according to their weight.

4. Southern blotting

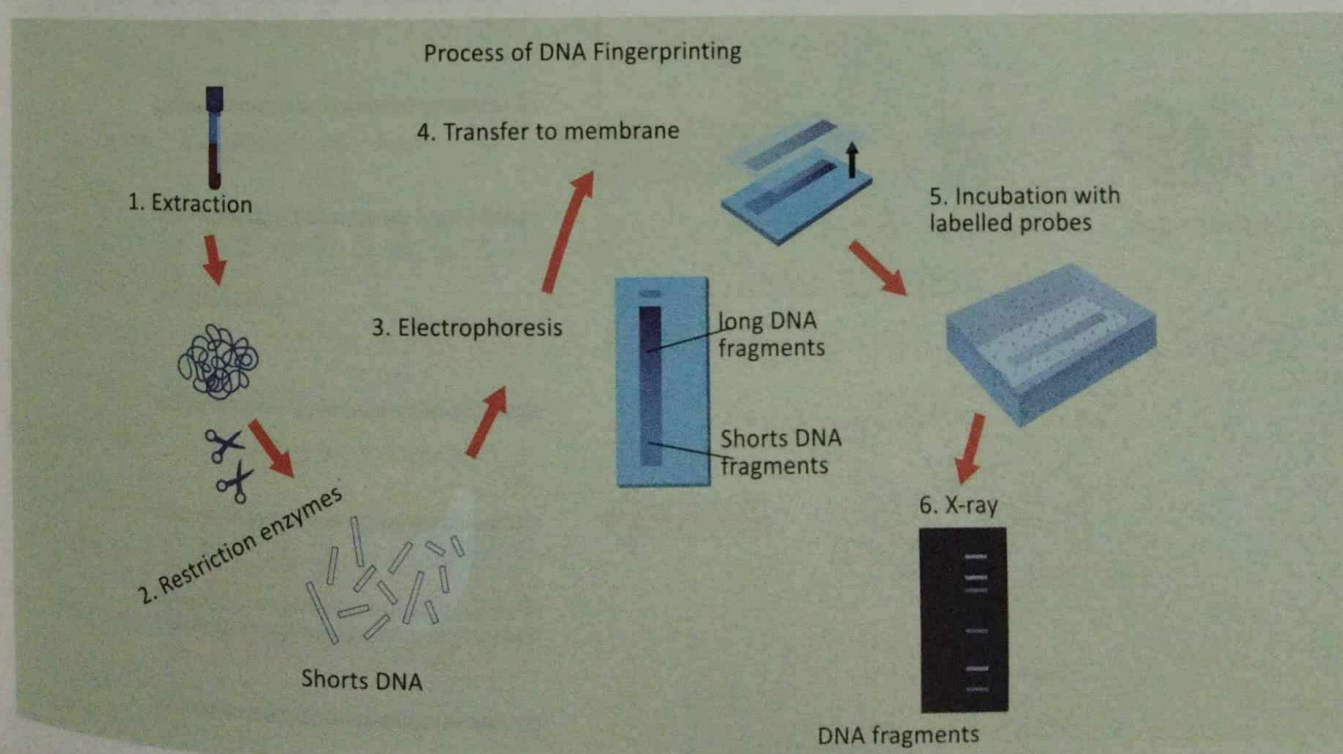
When subjected to electrophoresis on agar gel media, they are arranged according to their molecular weight in a pattern. These fragments are transferred from gel to Nylon membrane by the technique-Southern Blotting.

5. Hybridisation

Radioactive probes are added to catch the VNTR fragments and excess probes are washed off.

6. Visualisation

The hybridised fragments are visualised by auto radiography, an X-ray film is placed in direct contact with the probe labelled membrane. The fragments are copied on the X-ray film which is kept as a permanent record.



PCR technique: Polymerase Chain Reaction is commonly used in present era

- ❖ Polymerase chain reaction (PCR) is a laboratory technique for rapidly producing (amplifying) millions to billions of copies of a specific segment of DNA, which can then be studied in greater detail. PCR involves using short synthetic DNA fragments called primers to select a segment of the genome to be amplified, and then multiple rounds of DNA synthesis to amplify that segment.
- ❖ PCR requires a DNA polymerase enzyme that makes new strands of DNA, using existing strands as templates. The DNA polymerase typically used in PCR is called *Taq polymerase*.

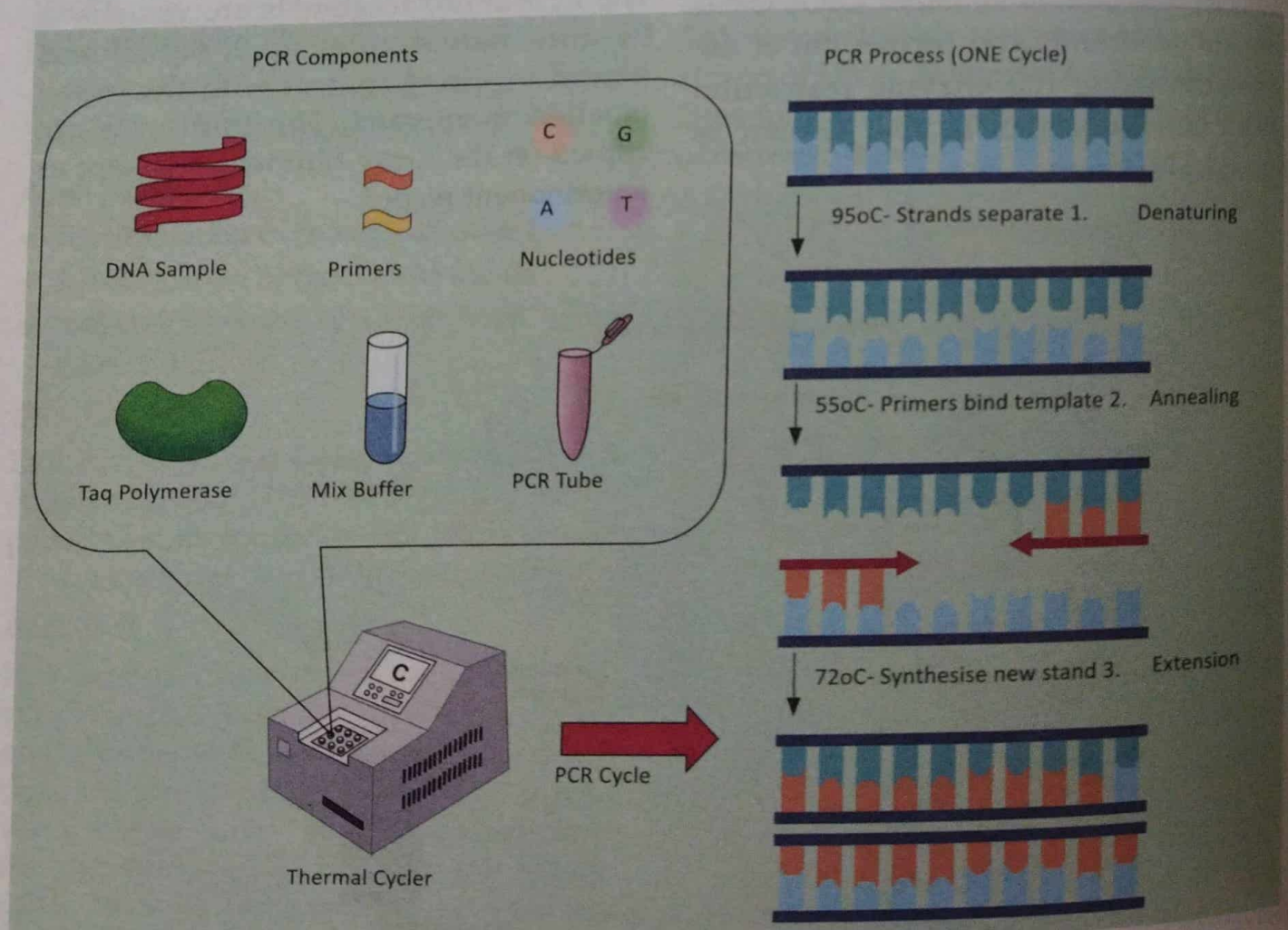
- ❖ PCR amplification technique is done in thermocycler using PCR tubes, repeating the cycle 30-40 times.
- ❖ PCR products are then subjected to electrophoresis, using capillary or gel electrophoresis and bands are produced.
- ❖ To observe the bands fluorescence detection system has been developed.
- ❖ This method does not require radioactive labelled DNA probes.

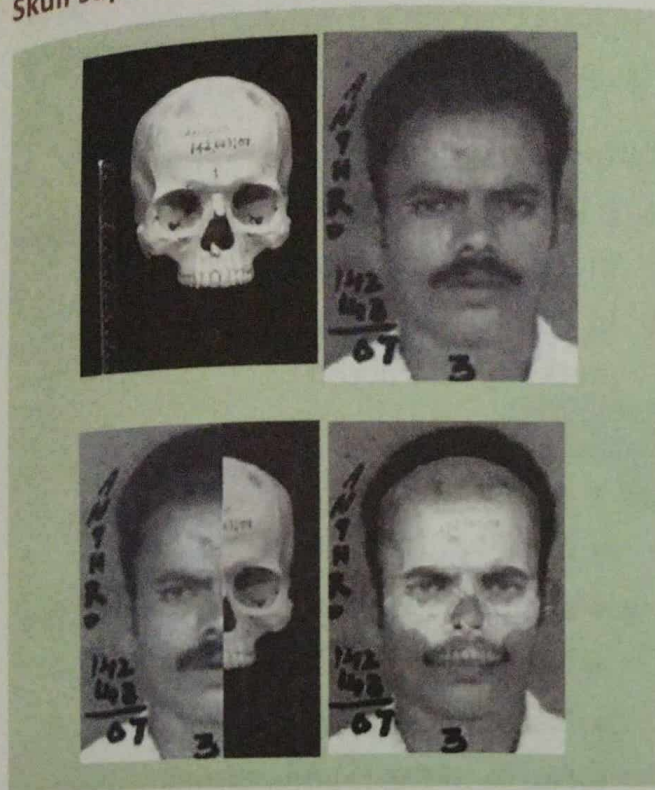
See the Fig Down

Superimposition

Two types

- ❖ Skull superimposition
- ❖ Video superimposition



Skull superimposition

- ❖ It has more of negative value.
- ❖ It is a technique in which postmortem record is placed over a similar or comparable antemortem record.
- ❖ Skull superimposition/cranio-facial superimposition in which the skull to be identified is superimposed on a recent antemortem photograph of the suspected deceased.

- ❖ The antemortem photograph is enlarged to life size, the enlargement factor is based upon the measurement of the fabric on the victim or other measurable items seen in the photograph or focal length of the lens used in the camera or the dimensions of the anterior teeth.
- ❖ The skull is adjusted in a way that the inclination and the orientation are the same as that of the head in the photo.
- ❖ A life size picture is taken and superimposed on the transparency of the life size ante-mortem photograph making allowances for soft tissue and hair thickness.
- ❖ The anatomical landmarks compared for a positive match includes: External auditory meatus, orbits, anterior nasal spine, chin, angles of the mandible and zygomatic processes.
- ❖ Arriving at a positive match does not always mean a positive identification since a photograph of any other person with similar craniometry can produce a positive match.
- ❖ This test can help in exclusion rather than conclusion.

Summary

Identification

It is determination of the individuality of a person

Types

1. Complete identification
2. Partial identification

Need of identification

1. In living persons
2. In dead persons

3. In skeletal remains**Major criteria's required for identification**

- ❖ Race, religion & nationality
- ❖ Sex
- ❖ Age
- ❖ Stature, general body built
- ❖ Complexion
- ❖ Hair
- ❖ Fingerprint

- ❖ DNA typing
- ❖ Birth abnormalities

Race

- ❖ Major race: Caucasoid/ Caucasians, Mongolians, Negroes.
- ❖ Minor race

Caucasians	Mongolians	Negroes
Thin & fair skin	Yellowish or pale skin	Black or tough skin
Blue or grey iris	Black iris	Black iris
Thin, straight/wavy fair/light brown/reddish, scalp hair	Moderately thick, black, straight/wavy hairs	Thick, black, curly, wooly hair
Raised forehead	Inclined forehead	Small & compressed forehead
Mesocephalic skull CI= 75-80	Brachicephalic (CI=80-85)	Dolicocephalic (CI= 70-75)

Sex determination

1. In living person
2. Dead, decomposed, skeletonized body
3. Gonadal agenesis
4. Gonadal dysgenesis

Estimation of Age

1. Physical development
2. Age estimation by teeth
3. Age estimation by ossification activities and growth of bones

Stature

- ❖ Stature means height or body dimension in vertical direction
- ❖ It is a main criteria in identification
- ❖ Starting from the intra uterine life, stature increases upto early 20's of that person
- ❖ After this age, though not of much significance it slightly reduces with further increase of age

Methods of stature estimation

1. Karl Pearson's formula
2. Trotter & Glesser's formula

Tattoo marks

- ❖ It is a very good identification mark both in living and in dead.
- ❖ In connection with identification tattoo marks speaks about :
 - Race
 - Religion
 - Nationality
 - Occupation
 - Language
 - Name of person,
 - Name of the relative, friend or lover

Scar for identification

- ❖ A scar is a product of healing of a wound by fibrosis and other body mechanism.
- ❖ A scar is made of fibrous tissue devoid of hair follicles, pigment and sweat glands and with lesser vascularity.
- ❖ The permanency of scar makes it an important tool of identification of the person.
- ❖ Things to be noted in scar: size, shape, site in relation with 2 anatomical landmarks.

Dactylography

- ❖ It is the study of the fingerprints.
- ❖ It is the process of taking the impressions of papillary ridges of the finger tips for the purpose of identification.
- ❖ Identification using fingerprint is absolute without any chance of error.
- ❖ Characteristic features of Dactylography: uniqueness, permanent.

Types

1. **Arches:** about 7%
2. **Loops:** about 65%
3. **Whorls:** about 25%
4. **Composite:** about 2-3%

Elements of fingerprints

- Type lines
- Delta
- core

DNA typing

- ❖ Identification by using DNA is also known as DNA fingerprinting.
- ❖ Using PCR technique a person can be identified in definite term from his/her old dead body remains, if parents or children are available.

Important Questions
MCQ

1. **Branch of science deals with study of hair**
 - a. Odontology
 - b. Osteology
 - c. Trichology
 - d. Thanatology
2. **Minimum age for consent of physical examination**
 - a. 16 yrs
 - b. 18 yrs
 - c. 12 yrs
 - d. 14 yrs
3. **Juvenile is a person below**
 - a. 16 yrs
 - b. 18 yrs
 - c. 12 yrs
 - d. 15 yrs
4. **Odontology deals with**
 - a. Teeth
 - b. Hair
 - c. Bone
 - d. Nerves
5. **Kidnapping is an offence under**
 - a. IPC 191, 193
 - b. IPC 361, 363
 - c. IPC 375
 - d. IPC 82
6. **Commonly used DNA typing method is**
 - a. RFLP method
 - b. PCR method
 - c. STR method
 - d. Mitochondrial DNA analysis
7. **Chance prints are**
 - a. Plastic prints
 - b. Visible prints
 - c. Latent prints
 - d. Patent prints
8. **Most common fingerprint pattern**
 - a. Arches
 - b. Loops
 - c. Whorls
 - d. Composite
9. **Which is considered as the most reliable criteria of identification?**
 - a. Lip prints
 - b. DNA analysis
 - c. Blood grouping
 - d. Dactylography
10. **Among all bones the most useful in sex determination is**
 - a. Skull
 - b. Mandible
 - c. Pelvis
 - d. Femur
11. **Brachicephalic people are**
 - a. Negroes
 - b. Aryans
 - c. Mongolians
 - d. Caucasoids

Answer key

1. c	2. c	3. b	4. a
5. b	6. b	7. c	8. b
9. d	10. c	11. c	

Learning Objectives

- Define identification, enlist the data of identification, describe the method of estimation of age based on teeth, ossification of bones, secondary sexual characters and general development.
- Describe the medicolegal importance of age, tattoo marks and occupational marks.
- Describe the medicolegal importance of hair, race, religion, sex and moles.
- Describe the medicolegal importance of handwriting, dactylography, DNA typing and superimposition.

Important SAQ

- What is meant by identification in forensic medicine? What are the factors commonly used for identification?
- Define cephalic index and its importance in identification.
- Write a short note on intersex in identification.
- Write a short note on fingerprints and its types in identification.
- What are the uses of tattoos in identification?

Important LAQ

- Define identification, its classification and write about age in identification.
- What is medico-legal importance of age?
- Write a short note on dactylography and its lifting methods.
- Write about DNA fingerprinting, its types and application.
- Write the importance of hair in identification.

• • •

Thanatology

19.1 Death

- ❖ **Death** – It is the permanent and irreversible stoppage of functions of three vital organs in the body (Bichat's tripods of life) – brain, heart and lungs.
- ❖ Leally says, "a person is said to be dead when somatic death occurs".
Legal definition of death:
- ❖ **IPC 46** says: "Death denotes death of a human being unless contrary appears".
- ❖ S.2 (b) of Death and Birth Act defines death as "permanent disappearance of all evidences of life, at any time after live birth has taken place".
- ❖ Thanatology is a branch of science that deals with study of death in all angles.

Death is not an event, it's a process

Death occurs in 2 phases

1. Somatic/systemic death/clinical death
2. Molecular death/cellular death

Somatic Death

It is defined as the complete and irreversible stoppage of vital functions of 3 organs heart, brain and lungs.

- ❖ Brain function
- ❖ Circulation

❖ Respiration:

- When these organs stop their functions, other organs also stop their functions as they are interdependent.
- But in the present days, the circulation and respiration are maintained by artificial means.
- So brainstem death is considered as the death of an individual.

Molecular Death

(Cellular death)

This is the death of the individual tissues or organs. It is the ultimate death of the cellular elements in the body. It usually occurs after a period of somatic death.

Brain dies fast

- ❖ Brain and nerves – in 5 minutes
- ❖ Cornea lives up to – 6 hours
- ❖ Kidney lives up to – 4 hours
- ❖ Muscles lives up to – 6 hours
- ❖ Skin lives up to – 2-4 hours

Benefits

- ❖ The benefits of the time lag between somatic and molecular death in which the organs can be transplanted to avoid minimal damage to tissues.

- ❖ Postmortem cooling, hypostasis and rigor mortis are the external signs of molecular death.

Differences between somatic and molecular Death

Somatic death	Molecular death
Complete irreversible stoppage of functions of 3 vital organs, brain, heart and lungs	Death of individual tissues and cells
Proceeds molecular death	Occurs after somatic death
Muscles responds to thermal, electrical or chemical stimuli	No responses to stimuli
Flat EEG, ECG, or absent heart and breath sounds	Algor mortis, Rigor mortis, hypostasis are the features
Resemble suspended animation, coma and hypothermia	No resemblance to any condition

Brain Death

Brain death is of three types:

1. Cortical or cerebral death with intact brain stem.
2. Brainstem death with intact cerebrum.
3. Whole brain death.

1. Cortical Death

- ❖ In cortical death or cerebral death, the cortex stops functioning but the brain stem functions.
- ❖ Causes: Cerebral hypoxia, widespread cortical damage and toxic conditions.
- ❖ The person stays in deep coma with loss of power of perception but respiration and circulation continue. This is called Persistent vegetative state (PVS). The person may be able to breath, open and close the eyes, swallow and make facial grimace.

- ❖ The most common cause of PVS is diffuse axonal injury.
- ❖ Complication of coma: Aspiration pneumonia, bed sores, urinary infections due to catheterisation, muscular dystrophy, DVT and so on.
- ❖ For this condition to be diagnosed. There must be a demonstration of no perfusion of the cortex via cerebral angiography. It is not sufficient to just show no EEG activity.

2. Brain Stem Death

- ❖ In this condition brain stem is dead, the cerebrum may be intact and the impulses from it are cut off by brain stem.
- ❖ In brain stem death, vital centres that control respiration stop functions and there will not be spontaneous respiration, and circulation.
- ❖ Patient becomes unconscious as the ascending reticular activating system (ARAS) is damaged.
- ❖ EEG pattern may show slight cerebral activity, though cerebrum is living it is functionally cut off by dead brain stem.
- ❖ The person stays in deep coma.
- ❖ Causes: Brain injury, cerebral edema, and increased intra cranial pressure.
- ❖ In India, Brain stem death is considered as the death of the person, in which life is practically impossible.

3. Whole Brain Death

- ❖ In this type, both cortical and brain stem functions stop irreversibly.
- ❖ Permanent and irreversible cerebral cortex, cerebellum and brain stem.
- ❖ In whole brain death, there is no point of return to life, and the dead can't be brought back to life by any means.

Criteria for Brain Death**Harward's criteria**

1. Unreceptivity and unresponsiveness
2. No movements or no breathing (Apnoea test)
3. No pupillary reflex (no response to light)
4. No corneal reflex (no blinking action on irritation of cornea with cotton wick).
5. No ocular reflexes :
 - Oculocephalic reflex: No dolls eye movement or eye is fixed on change of position of head.
 - Oculovestibular reflex/caloric test: No eye movement on irrigation of tympanic membrane with few drops of cold water.
6. Grimace reflex: Response to deep pressure on the nail bed, supra orbital ridge or temporomandibular joint.
7. Gag reflex: No swallow movement on irritation of posterior pharynx with tongue blade.
8. Flat EEG —
 - If all these reflexes suggest no life, the person is again placed on ventilator and after 6 hours this process is repeated. There is no responses, the person is placed him again on the ventilator.
 - This process is repeated 4 times in 24 hours.
 - If there is no response with isoelectric EEG, death can be confirmed.

Apnoea test

It should be done to a patient on a ventilator. Before looking for spontaneous respiration, 100% of oxygen should be given via ventilator for 10 minutes and 5% CO₂ in oxygen for 5 minutes. This is done to prevent hypoxic brain damage.

Then the patient should be disconnected from the ventilator for a period of 10 minutes and allow the CO₂ to build up to a point where it would trigger respiration if there is any living cell present in the respiratory centre of brain stem. At the end of the disconnection period CO₂ can be estimated in the arterial blood to ensure it has reached a level of 50mm Hg.

Before doing the Apnoea test, conditions should be excluded like:

1. Hypothermia
2. Metabolic and endocrine disorders
3. Coma due to drugs
4. Alcohol intoxication
5. Hypovolemic shock

Death certification done by —

1. Doctor in charge of the hospital.
2. Neurologist (or physician if neurologist not present).
3. Doctor treating the patient.
4. Independent RMP (physician in Govt. services- in Kerala state government amendment).

Transplantation

After the certification of death, organs can be transplanted successfully.

Lungs and liver should be removed within 15 minutes of death, kidney in 45 minutes, heart in 1 hour, cornea in 2 hours, skin and blood vessels in 24 hours and bones in 6 hours.

Beating Heart donor

A beating heart donor is an individual whose heart is still functioning at the time of organ retrieval for transplantation. This allows for better preservation and viability of the donated organ particularly critical one like

heart. This method of transplantation is not followed in India.

Modes of Death

Mode of death indicates the **most affecting system** and loss of its function makes the person dead.

There are 3 modes of Death

1. Syncope
2. Asphyxia
3. Coma

In coma, brain is mostly affected. Syncope means circulation is affected. Asphyxia means the respiratory system is affected. It is very difficult to conclude the cause of death based on modes because all these three modes are interrelated. So doctors should not mention "the cause of death is cardio pulmonary failure". It is very vague and does not give an idea about the actual cause of death.

Mechanism of Death

Physiological process that occurs in the body leads to death. E.g. haemorrhage, septicaemia, metabolic acidosis, etc.

In case of hanging, the mechanisms are constriction of neck and mechanical asphyxia.

Cause of Death

An injury or a disease produces physiological derangement which results in death. Thus, is the cause of death can be gunshot wound to abdomen, stab wound to chest, or adenocarcinoma of the lungs.

If the person dies due to heart attack (MI), the mechanism is thrombus occluding the artery and the cause of death is coronary atherosclerosis, and the mode is syncope.

Manner of Death

Manner of death means whether the death was caused due to any natural disease or by suicide, homicide or accident.

Death Certification

- ❖ It is a the legal document issued by a medical practitioner which says about the date, time and cause of death of a person. It is very essential for govt. agencies to update the statistical data.
- ❖ A registered medical practitioner can certify death if there is no respiration or circulation for 10 minutes. Auscultate with the stethoscope for heartbeat, and respiration, feel the pulse and observe the pupillary reflex. If all are absent, death can be certified in a usual circumstances.
- ❖ A death certificate contains the person's name and address, panchayat/municipality, place of death, date and cause of death.
- ❖ It must be issued by a doctor attending and no fee is charged.
- ❖ The doctor should know the terminologies of death certification according to ICD 10 code.

Death certificate contains

1. Underlying cause of death: The condition which triggered the chain of events in death.
2. Immediate cause: Final complication from the underlying cause of death, this is the symptom which is very near to death.
3. Intermediate cause of death: A disease or condition that occurs as a result of the underlying but not the final cause or immediate cause of death.
4. Mechanism of death: It is the physiological derangement or biochemical disturbance (cardiac arrest, respiratory arrest). It cannot be used as an underlying cause of death.

Example of Death certificate

Example of a correctly filled-out death certificate

Frame A: Medical data: Part 1 and 2		
Part I	Cause of death	Time interval from onset to death
a. disease or condition directly leading to death	a Renal failure	1 year
b. chain of events in order (if applicable)	b Nephritic Syndrome	3 years
c. State the underlying cause (if any)	c Diabetes mellitus	20 years
	d	
Part II other significant conditions contributing to death (time intervals can be included in brackets after the condition)		Ischaemic right foot (months)

International Form of Medical Certificate of Cause of Death

Cause of Death		Approximate interval between onset and death
I		
Disease or condition directly leading to death*	(a) Immediate causes	
Antecedent causes	(b) Intermediate causes	
Morbid conditions, due to (or as a consequence of) if any	(c) Intermediate causes	
giving rise to the above cause, stating the underlying condition last	(d) Underlying causes	
II		
Other significant conditions contributing to the death, but not related to the disease of condition causing it		

* This does not mean the mode of dying e.g. heart failure, respiratory failure it means the disease, injury or complication that caused death

Suspended Animation

- ❖ It is also called apparent death (death trance). The vital functions of the body

are maintained at a subnormal and non-demonstrable level. The heart beat and respiration are reduced to a minimum and not detected in the routine clinical methods.

- ❖ **Mechanism** – the metabolic rate is so reduced that the requirement of the cells for oxygen is satisfied through the oxygen dissolved in the body fluids.
- ❖ **It can be of two types:** Voluntary and Involuntary. Voluntary suspended animation is usually practiced in Yoga. Involuntary suspended animation is mostly seen in
 - Drowning
 - Electrocution
 - Hanging
 - Sunstroke
 - Anesthesia
 - New born babies
 - Hypothermia
 - Poisoning affecting brain e.g: barbiturates, opium
 - Head injury

ML Importance

- ❖ It is very important to understand about such condition for avoiding premature certification of death.
- ❖ For resuscitation of the person.

Test of confirmation of death (only historical importance)

Test to confirm cessation of respiration

- ❖ **Feather test:** No movement when a feather is placed in front of the nostril.
- ❖ **Mirror test:** No haziness when a mirror is placed in front of the nostrils.
- ❖ **Winslow's test:** No movement of surface of water in bowl kept on the chest.

Test to confirm cessation of circulation

- ❖ **Magnus test:** No bluish discolouration to the tip of finger when a ligature is applied.

- ❖ **Diaphanous test:** No trans illumination when light is shown on web space.
- ❖ **I card's test:** Fluorescent dye injected at a given site on the dead body fails to produce any dis-colouration to the surrounding tissue.
- ❖ **Pressure test:** No colour change due to filling of blood when pressure is applied on finger.

19.2 Signs of Death

I. Immediate changes

- ❖ Cessation of respiration
- ❖ Cessation of circulation
- ❖ Insensibility
- ❖ Loss of voluntary power
- ❖ Dilatation of pupil

II. Early changes

- ❖ Retinal changes and changes in vitreous humor
- ❖ Primary flacidity
- ❖ Algor mortis
- ❖ Livor mortis
- ❖ Rigor mortis

III. Late changes

- ❖ Putrefaction
- ❖ Adipocere changes
- ❖ Mummification

Stoppage of respiration can be tested by auscultation for absence of respiratory sounds for more than 10 minutes.

Stoppage of circulation can be tested by checking the pulse, heart sounds and ECG response.

All these should be absent for more than 10 minutes.

Immediate changes

Changes in the Eye

- ❖ Loss of lusture of cornea
- ❖ Cornea became opaque

- ❖ Fall of intra ocular tension (normally 10-21mm Hg); it falls to zero.
- ❖ Tache noire: Cornea and conjunctiva become dry and discoloured on exposure to air. This occurs due to the deposition of cell debris and dust.

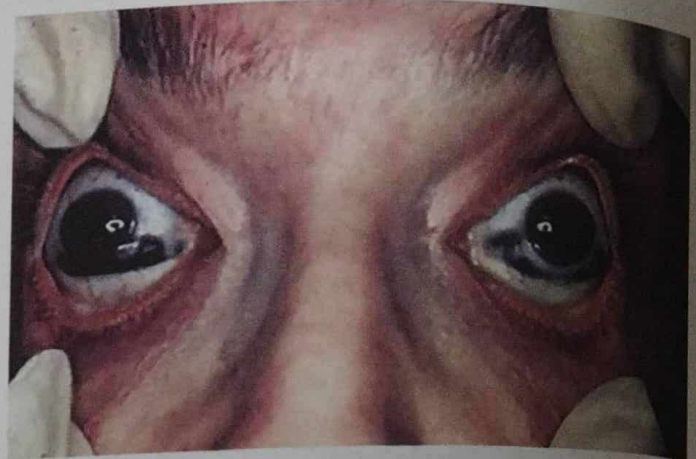


Fig: Tache Noire

Retinal changes

- ❖ On ophthalmoscopic examination, the retinal vessels show segmentation within 10-15 seconds. This is called rail roading, trucking or Kevorkian sign.
- ❖ This trucking is the earliest sign after death. This will persist for about 1 hour.
- ❖ Retina will be pale and optic disc gets hazy by 6-10 hrs after death.

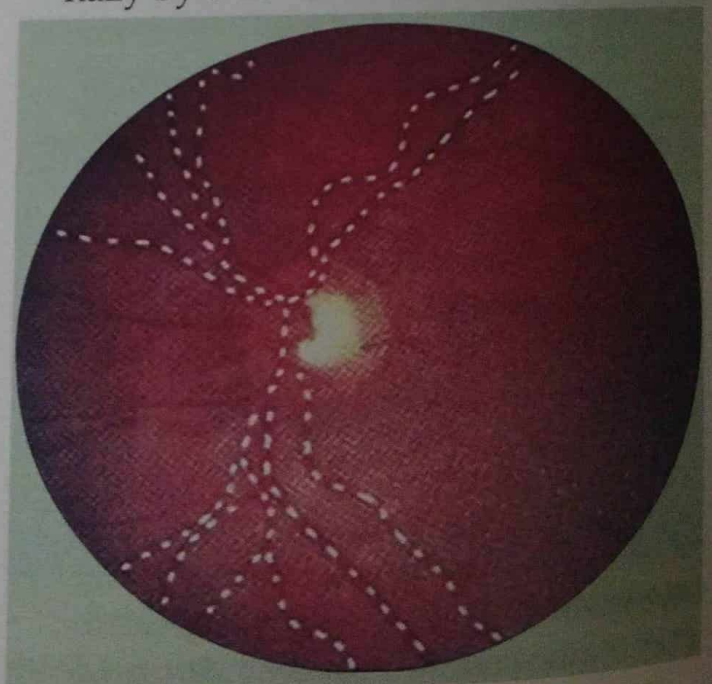


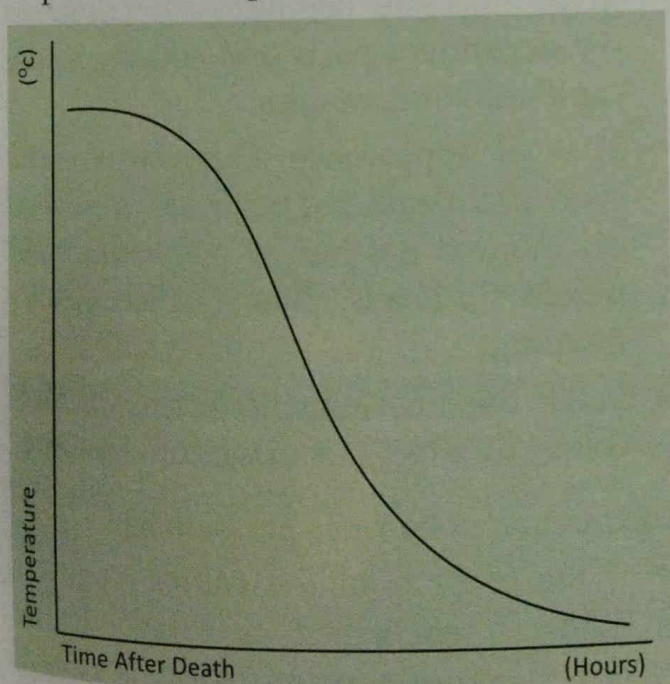
Fig: Trucking

Changes in the vitreous humor

According to Sturbner and Gantner, Calcium ion (Ca^{++}) decreases, K^{+} ion increases and Na^{+} decreases as time passes.

Early Changes**Algor Mortis****(Postmortem cooling or chill of death)**

- ❖ It is the cooling of the body after death.
- ❖ It is an early postmortem sign.
- ❖ There is a constant balance between heat production and heat loss during life. After death, there is only heat loss, so the temperature starts falling and the body cools down.
- ❖ The heat loss starts from the surface initially, and a temperature gradient is established between core and surface temperatures.
- ❖ Body cools until the core temperature reaches the atmospheric temperature.
- ❖ The rate of cooling after death can be plotted as a sigmoid curve



- ❖ **Initial plateau phase:** May be for 3-4 hours after death, rectal temperature does not increase. Some residual metabolic process in the dying tissues continue to generate

heat for some time after death, mainly in liver.

- ❖ **Slope of the curve:** It corresponds to the period of rapid cooling.
- ❖ **Final flat curve:** The graph at the end shows flattening because the temperature differential between the body and the atmosphere approaches zero.

Recording temperature in dead bodies

- ❖ Chemical thermometer or Thanato meter ($0-50^{\circ}\text{C}$) gradient is used.
- ❖ Rectum is the ideal place of measuring temperature, except in case of sodomy, the thermometer inserted 8-10cm into the rectum and left there for 2 minutes.
- ❖ The temperature can also be measured by inserting under the liver (sub-hepatic) through a slit made in the anterior abdominal wall.
- ❖ Other areas: Axilla, deep nasal passage and external auditory meatus.

Time since death can be roughly estimated as

$$\text{Time since death} = \frac{\text{normal body temperature} - \text{rectal body temperature}}{\text{Rate of fall in temperature per hour}}$$

Factors affecting the Rate of cooling**1. The environmental temperature:**

- It is the major factor affecting cooling. As the environmental temperature decreases, the cooling is rapid and rate of fall of temperature is more. In temperate (cold countries), the rate of cooling is 0.5°C/hr and in tropical countries, the rate of fall is roughly 0.25°C/hr .

2. Temperature of the body at the time of death

- If the temperature of the body at the time of death is high (PM caloricity), the body will take longer time to cool.

- If the temperature is low at the time of death, the body will take little time to cool. E.g: alcohol poisoning, opiates poisoning, hypothermia and cholera.
- 3. **Build of the body:** Rate of cooling is proportional to the ratio of surface area to the weight of the body, so children and elderly people cool immediately.
- 4. **Physique of the cadaver:** Fat is a bad conductor of heat, so bulky bodies cool slowly compared to lean bodies.
- 5. **Air circulation:** Body in the open air cools faster than the body in a closed room.
- 6. **Coverings on the body:** When the body is covered with thick cloth, the cooling will be slower.

Postmortem Caloricity

The temperature of the body/remains high in the initial period after death. This is because of increased metabolic activity in the cells even after death. The estimation of time since death will be affected, if the body temperature rises after death. It happens commonly in the following situations:

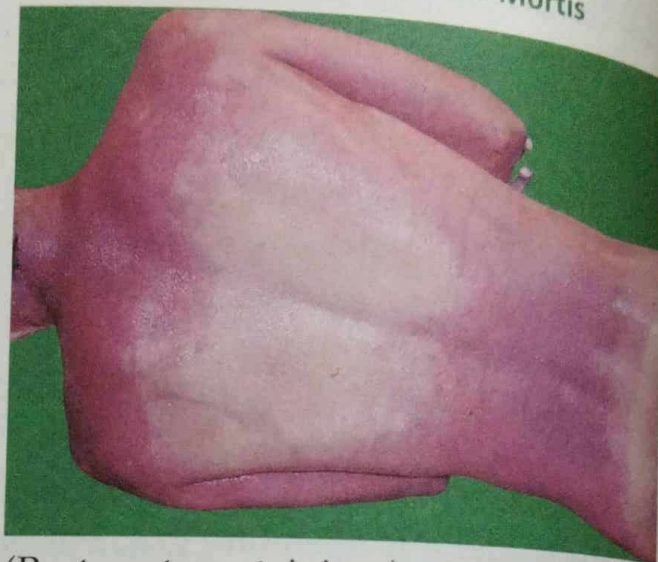
- ❖ When the temperature regulating mechanism is severely affected before death as in –
 - Sunstroke
 - Pontine haemorrhages
- ❖ When at the time of death there is an increase in the heat production in muscles due to convulsions like –
 - Tetanus
 - Encephalitis
 - Strychnine poisoning
- ❖ When there is an excessive bacterial activity as in cases of –
 - Septicemia
 - Meningitis
 - Typhoid

Medicolegal Importance of Algor Mortis

1. It is a sign of death.

2. It helps in the estimation of time since death.
3. Rapid cooling of dead body delays decomposition process in cold countries.

Postmortem Hypostasis/Livor Mortis



(Postmortem staining/cadaveric lividity/vibices/postmortem lividity/suggilations)

- ❖ It is the colour seen on the dependent part of the body due to pooling of blood caused by gravitational force, after death.
- ❖ After death, circulation stops and blood in the fluid state begins to settle down in the dependent parts and collects in the capillaries and venules.
- ❖ Time of appearance: Hypostasis starts soon after death but begins to appear as discoloured patches of 1-2cm diameter within 1-2 hours. This is called patchy mottling.
- ❖ Later they coalesce to form uniform colour by 5 hrs. It is maximum by 6 hrs.

Distribution of Postmortem staining

- ❖ If the body is in the supine position, lividity forms in the back of the body. If it is in the prone position, lividity is formed in the front of the body.
- ❖ In hanging cases, lividity is seen on the distal part of the extremities and lower part of the face (glove stocking pattern).

- ❖ In case of drowning, it will be on the face, shoulders, upper part of front of chest and shoulders, lower arms, feet and lower legs (if the body in prone position with limbs down).
- ❖ Hypostasis does not develop if the body is moving on turbulent flow of water.
- ❖ Postmortem staining is absent in the part of the body which is in contact with the surface. It is called Contact pallor.
- ❖ In case of bodies lying in prone position, there is hypostasis in the eye and it may be mistaken for sub conjunctival haemorrhage. This may be falsely interpreted due to suffocation or smothering.
- ❖ Sometimes PM staining may be mistaken for contusion.
- ❖ To distinguish between PM staining and contusion, an incision is made; in contusion blood infiltrated to the other surrounding tissues and in PM lividity, blood is confined in the cutaneous capillaries only.
- ❖ Areas of constricted body parts and tight clothing may cause white marks devoid of PM staining. This may be mistaken as ligature marks in strangulation.
- ❖ Uneven pressure of constriction agent like belts, underwear, clothing or beddings cause certain pattern of hypostasis.
- ❖ The postmortem staining when first appears is called as Primary lividity and when it appears in a new position, it is called secondary lividity.
- ❖ Lividity is more prominent in asphyxia death and less marked in anaemia, hypovolemia or severe haemorrhage.

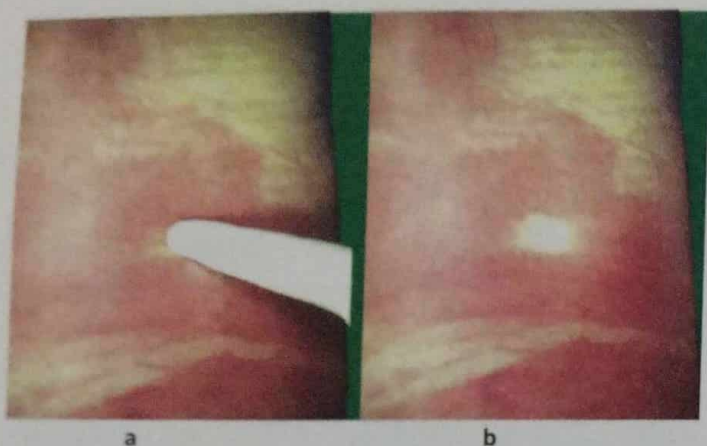
Differences between contusion and postmortem hypostasis

S.No.	Hypostasis	Contusion
1.	Seen in dependent part of the body	Seen anywhere in the body
2.	It is a postmortem change	Due to blunt force
3.	Confined to the blood vessels only	Infiltration by rupture of blood vessels and extravasation of blood
4.	On incision, blood is not seen in deeper tissues	Blood is seen in deeper tissues on incision
5.	Well defined margins	Not well defined, merged with surrounding area
6.	May blanch when pressed	Will not blanch
7.	Area is not elevated	Edges are elevated
8.	Uniform in colour	Changes in colour due to healing
9.	Changes position when it is not fixed	Do not change in position
10.	Microscopical examination does not show Vital or enzymatic reaction	Shows vital reaction

Fixation of Hypostasis

- ❖ It is supposed to be 6-12 hrs.
- ❖ If the PM staining is fixed, the time since death is more than 6 hrs and if it is not fixed, time since death cannot be assessed.
- ❖ Before fixation of PM lividity, if the body is turned over to a different position, the hypostasis already present on the dependent part (primary lividity) may disappear and it may appear at a new dependent part (secondary lividity).
- ❖ Lividity persists till putrefaction sets in.
- ❖ On areas of staining, thumb is firmly pressed for 30-45 seconds, the staining is

displaced and there will be blanching if it is not fixed.



Colour of Hypostasis

- ❖ Colour of hypostasis is the colour of blood.
- ❖ Colour is better appreciated in fair skinned people.

Colour	Seen in
Cherry red colour	CO (Carbon monoxide)
Bright red	CN (cyanide)
Bluish green	H ₂ S
Bright pink	Hypothermia
Dark brown or yellow	Phosphorous
Chocolate	Aniline, nitrates
Black	Opiates

- ❖ Deoxygenated blood is in pink colour
- ❖ Hypostasis is also seen in the dependent portions of internal organs like liver, lungs, heart and intestines (should not confuse with contusion).
- ❖ Hypostasis in the posterior aspects cerebellum and cerebrum, lying in supine position confuses with subarachnoid haemorrhage.

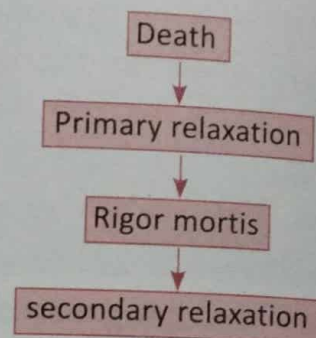
Medicolegal significance of Hypostasis

- ❖ It is a sign of death.
- ❖ It gives an idea about the position of the body after death.
- ❖ Hypostasis in 2 different position indicates change of position of body.

- ❖ Time since death could be assessed in case of fixation of hypostasis.
- ❖ Cause of poisoning can be understood in death due to poisoning.
- ❖ Differentiate between contusion and internal haemorrhages.

Rigor Mortis

After death, the muscle undergo changes like primary flaccidity, rigor mortis and secondary flaccidity.



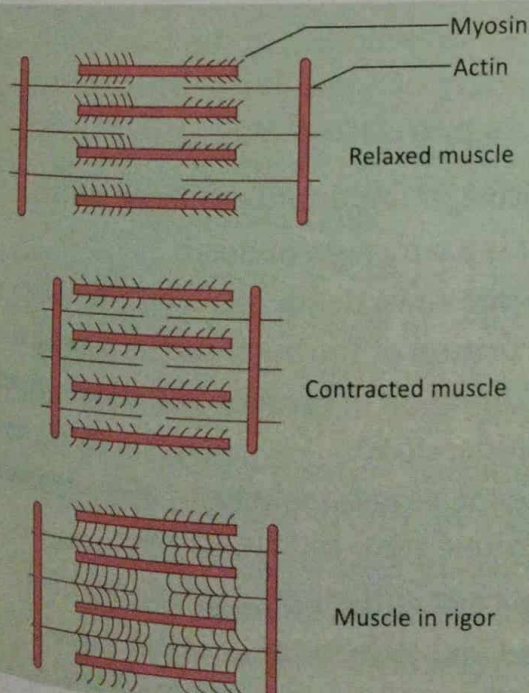
Primary Flaccidity

- ❖ Immediately after death, the muscles become loose and relax. The lower jaw falls, the eye lids loose tension and all joints become flexible.
- ❖ The muscles are relaxed as long as the ATP content in the cells remains and permits splitting of actin myosin complex, muscular irritability and response to mechanical and electrical stimuli will persist till then.
- ❖ Peristalsis and ciliary movements will continue till the depletion of ATP.
- ❖ Contact flattening occurs in the area in contact with the surface and gets flattened due to loss of tone of muscles. So if the body is in supine position, flattening may be seen in over the scapular region, buttocks and on the back of heads.

Rigor Mortis or Postmortem Rigidity

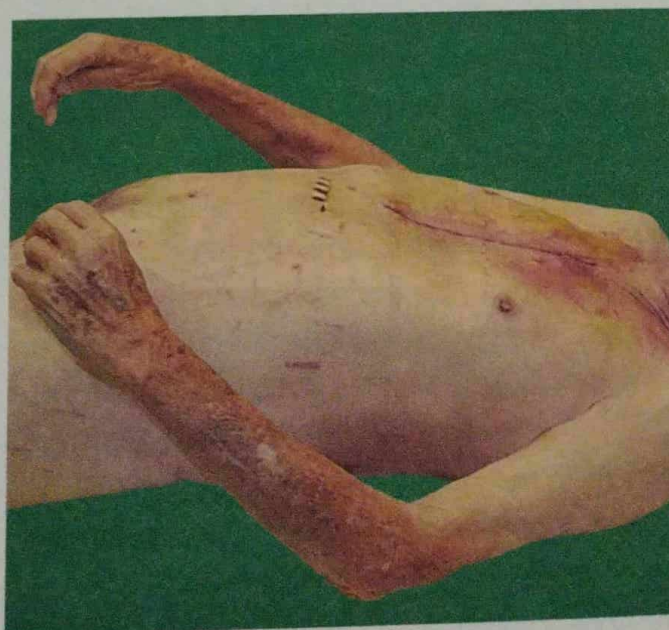
It is the postmortem stiffening of the muscles :

- ❖ It is a physio-chemical phenomenon in which both voluntary and involuntary muscles of the body after primary flaccidity.
- ❖ Muscles in the body are made of fibres known as myofibrils, these myofibrils are having contractile elements called Actin and Myosin.
- ❖ Separation of actin and myosin is responsible for extensibility and softness of muscles.
- ❖ Coming together of these actin and myosin filaments, which result in contraction, is dependent on the energy provided by Adenosine triphosphate (ATP). Constant supply of ATP is maintained in life.
- ❖ Failure of re-synthesis of ATP after death, results in the muscles becoming hard and rigid. However, some amount of ATP is still available after death till the glycogen reserve lasts.
- ❖ Once this glycogen reserve is depleted, there is no more ATP available, and the contractile elements are converted into dehydrated, stiff, gel like mass resulting in the muscles themselves becoming hard and rigid.



The order of appearance of rigor mortis

- ❖ All muscles of the body, both voluntary and involuntary, are affected.
- ❖ Rigor mortis is first affected in the myocardium, and it becomes rigid within half an hour to one hour.
- ❖ Externally it first appears in the eyelids, then lower jaw, muscles of the face, neck, upper limbs, and finally in lower limbs. The descending pattern or proximo-distal progression is called Nysten's rule.
- ❖ This proximo distal pregression of rigor is apparent. Actulally, it develops simultaneously in all muscles. But the changes are demonstrable first in small group of muscles since rigor mortis depends upon the volume of the muscles (sharpio).
- ❖ When the rigor is fully established the whole body becomes stiff.
- ❖ The rigor of erector pilae muscles attached to the hair follicles may cause pimpling of the skin, Cutis anserina or goose skin.



Rigor mortis



Cutis anserina (Rigor of erector pilorum muscles) after death

Time of onset of rigor mortis

- ❖ In tropical country like India, it begins in 1-2 hours, and can be demonstrated in the eyelids in 1-2 hours.
- ❖ It is fully established all over the body in 4-6 hours.

Passing of Rigor

- ❖ It begins and pass of by 18 hours. Passing of rigor also follows proximo distal manner. In the body, rigor mortis stays maximum duration in the muscles of lower limb.
- ❖ It follows a rule called Rule of 12 or march of Rigor. (In India it is rule of 6), that is rigor mortis is established in 12 hours, and retained in the body for the next 12 hours and pass of from the body in next 12 hours.
- ❖ Passing of Rigor mortis is due to the release of autolytic enzymes stored in lysosomes. The major proteolytic enzymes are cathepsins and calpains. These act on the actomyosin complex and hydrolyse them and muscles become soft again.
- ❖ Rigor mortis is demonstrated by lifting the eyelids, depressing the lower jaw, bending the neck and flexing the limbs.
- ❖ When the fully established rigor is broken, it will not reappear, but partially

established rigor if broken, it may reappear.

- ❖ Internally heart muscles are the first organs to show rigor mortis because heart is the last organ to stop and ATP is almost completely used up in heart muscles at the time of death.

Factors affecting Rigor mortis

1. Nature of the body

Rigor mortis sets early and pass of early in lean bodies than in bulky bodies. Rigor sets early in children than in adults.

2. Nature of death

- In violent death like firearm, cut throat, electrocution and in lightning, rigor mortis sets earlier.
- In death due to violent muscular convulsion, tetanus or strychnine poisoning, rigor mortis occurs rapidly due to the depletion of ATP.

3. Atmospheric conditions

- Onset of rigor mortis is slower and the duration is longer in cold weather than in hot climates. In warm weather, rigor mortis establishes early because of the increased breakdown of ATP.
- Disappearance of rigor is very fast in warmer areas due to early occurrence of putrefaction.

Medicolegal importance of Rigor mortis

1. It is a sure sign of death.
2. Time since death could be assessed.
3. Position of the body can be assessed.
4. Alteration of position of the body can be understood.
5. Some situations which may simulate/mimic rigor mortis are like:
 - Heat stiffening
 - Cold stiffening
 - Gas stiffening

- Cadaveric spasm

Conditions simulating rigor mortis

1. **Heat stiffening (pugilistic attitude):** When a dead body is exposed to a temperature above 65°C , the body becomes rigid. This is due to the coagulation of proteins. Examples: burns and scalds.
2. **Cold stiffening:** When a body is exposed to freezing temperature, it may become frozen and stiff. It is due to solidification of subcutaneous fat. It also occurs in the synovial fluid of the joint.
3. **Gas stiffening:** Gases of decomposition will be formed in the joints and the joints will be stiffed, like rigor mortis. Gas stiffening occurs 48-72 hours after death.
4. **Cadaveric spasm:** (Instantaneous rigor, Cataleptic rigidity).

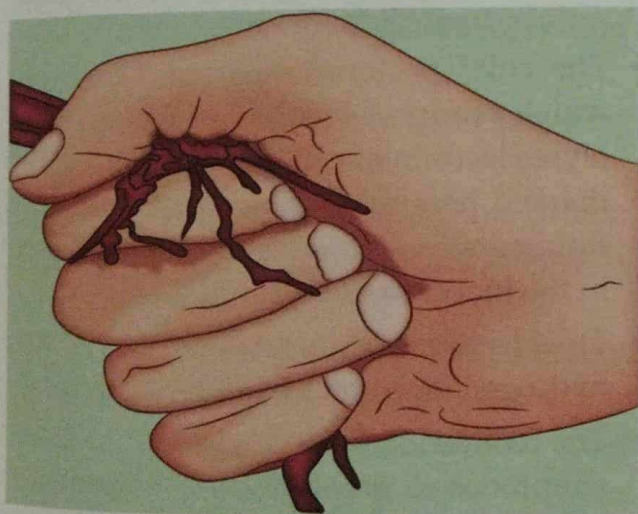


Fig: Cadaveric Spasm

- It is a condition in which muscles of the body which were in a state of contraction, immediately before death, continue to be so after death without entering into the primary flaccidity.
- It is very rare and occurs in violent forms of death, thus seen in suicides by stabbing or gun-shot injuries where we can see the weapon firmly grasped in the hand.

- The cable wire may be seen firmly gripped in hand in electrocution cases.
- In drowning cases, weed particles may be seen firmly grasped in hand which indicates that the person was alive while entering the water.
- In rare instances, the whole body is affected as of soldiers getting shot in the battle, the body adopts the posture he was in while getting shot.
- Cadaveric spasm remains without interruption and rigor mortis affects the whole muscles of body. Cadaveric spasm disappears from the body along with rigor mortis.
- Mechanism of cadaveric spasm: It is not clear and is supposed to be due to the sudden depletion of ATP in the muscles of action with persistence of contraction even after death. Neurogenic cause is also suggested.

Medicolegal significance of cadaveric spasm

1. **Suicides:** Pistol or knife firmly gripped in hand of victim strongly suggests suicide.
2. **Homicide:** Some criminals may try to keep the weapon in the hand of the victim after killing to simulate suicide, but firm grip as in cadaveric spasm cannot be seen. The way in which the weapon is placed in hand may not be in the correct position also. If the weapon is tied in the hand until rigor mortis sets in, there may be tying marks in the hand.
3. **In murder due to assault:** Piece of clothing or button of the assailant, or hair firmly gripped in the hands may be seen.
4. **In drowning:** The weed particles, twigs or vegetation may be seen grasped in the hand. This shows that the victim was alive at the time of entering water.
5. **Electrocution deaths:** Sometimes the cable wire may be firmly grasped.

6. It indicates the last action of the victim.

Differences between rigor mortis and cadaveric spasm

Rigor mortis	Cadaveric spasm
Muscle stiffening more marked	Muscle stiffening marked
Molecular death occur	Molecular death does not occur
body temperature- body cold	Body temperature- warm
Muscles do not respond to electrical stimuli	Muscles respond
Muscles involved- all muscles involves	Only a small group of muscles affected
Medico legal significance- time since death can be calculated	Mode and manner of death can be understood
Mechanism- depletion of ATP	Not exactly known

Secondary flaccidity

When rigor mortis is passed, the muscles become flacid, which is called the secondary flaccidity. This is due to lysis of muscle proteins as decomposition sets in.

Late Changes

Decomposition

It is the disintegration of the body tissues after death. It includes 2 parallel process, which starts soon after death :

1. Autolysis (absence of microbial activity)
2. Putrefaction (it occurs due to microbial activity)

Decomposition = autolysis + putrefaction

Autolysis or Enzymatic auto digestion

- ❖ After death, the cell membranes start to break down and the cytoplasm containing lytic enzymes (glycolytic, proteolytic and lipolytic) is released from these disintegrating cells into extracellular space. These enzymes start breaking (autolytic) or start digesting (auto-digestion) other cells and tissues.

- ❖ Since this autolysis occurs without any microbial activity, it is called aseptic.
- ❖ It starts in the organs rich in autolytic enzymes; for instance: pancreas, gastric wall and liver.
- ❖ Maceration is the process of autolysis which occurs in a dead foetus when it remains in the uterus 3-4 days surrounded by liquor amnii, but with intact membrane and exclusion of air.
- ❖ Gastromalacia is the autodigestion of the gastric wall, often with perforation.

Putrefaction

- ❖ It is a late change that occurs after disappearance of rigor mortis.
- ❖ It is the breakdown of complex organic substances into simple inorganic substances.
- ❖ It occurs due to the anaerobic bacterial activity, mainly in the intestines.
- ❖ The chief bacterial agent is *Cl.welchii* which produces lecithinase which hydrolyses lecithin of cell membrane, causing marked hemolysis, liquefaction of clots, disintegration of tissues and gas formation in the blood vessels and tissues.
- ❖ This lecithinase is responsible for the hydrogenation and hydrolysis of body fat.
- ❖ The other microorganisms include: streptococci, staphylococci, *B.proteus*, *B.coli* and *B.aerogenes*.
- ❖ Proteolytic, glycolytic and lipolytic action take place. Proteins are converted into amino acids, carbohydrates to CO_2 and water, lipids to fatty acids.

During the process of putrefaction, many **foul smelling gases** evolve, they are :

- Hydrogen sulphide
- Sulphur dioxide
- Ammonia
- Methane

- Carbon dioxide
- Carbon monoxide
- Mercaptans

These gases cause,

1. Dispersion of postmortem lividity and rigo mortis.
2. Ballooning effects of body.

Ballooning effects include:

- ❖ Disgusting ammoniac foul smell.
- ❖ Due to the gas formation, blood-stained frothy fluid comes out through orifices; gastric contents also come out through the mouth and nostrils (postmortem purging).
- ❖ Abdomen will distend, face will bloat up and scrotum, penis and female breast will engorge.
- ❖ On opening the peritoneal cavity, gas escapes with a large hissing noise.
- ❖ Eyes bulge out from their sockets, and tongue protrudes out.
- ❖ Gas bubbles accumulate in tissues causing crepitant sponge like feel.
- ❖ Accumulation of gas in the joints causes rigidity, which should not be confused with rigor mortis.
- ❖ Postmortem vesicles under skin, be may confused with scald.
- ❖ Skin detachment of hands and feet (degloving) occurs by 3-5 days.



Fig: Ballooning effect due to gas formation in decomposition



Fig: Skin vesicles in decomposition



Fig: Degloving of Skin (Glove stockings pattern)

Postmortem delivery: Due to the pressure of decomposition of gases, the foetus in the uterus along with placenta will be expelled out. This is called postmortem delivery. Usually is occurs 2-3 days after death. It should not be mistaken with criminal abortion.

Colour changes



Fig: Greenish discolouration of right iliac fossa

The first external sign of decomposition is the greenish discolouration in the right iliac fossa because that area is superficial and caecum with rich bacterial content lies there. This occurs in 15-18 hrs after death.

Marbling sign



Fig: Marbling

- ❖ Blood vessels provide an important route in which bacteria can spread easily throughout the body.
- ❖ The bacteria produce hydrogen sulphide which converts haemoglobin into **sulph-methhemoglobin** and the vessels are stained green due to this.
- ❖ This is seen as linear branch like patterns which give a marbled appearance to the skin.
- ❖ This is seen in about 36 hours.
- ❖ It is clearly visible in fair-skinned people and less visible in dark-skinned people.
- ❖ Marbling is first seen at the shoulders, upper aspects of limbs, thighs and lateral aspects of trunk.
- ❖ The first decomposition change seen internally is the staining of intima of aorta.
- ❖ As time advances, the whole body becomes green, greenish black or brownish black in colour.

- ❖ Black discolouration occurs due to the formation of ferric sulphide (ferric ion in $Hb + H_2S$).

Decomposition

- ❖ **Discolouration** – Greenish colour in right iliac fossa, marbling, staining of aorta and blackish discolouration.
- ❖ **Distention** – Abdomen, breast, penis, scrotum, eyes, face, lips, skin, vesicles and joints.
- ❖ **Discharges** – Purging, fecal discharge, PM delivery of foetus.
- ❖ **Detachment** – Peeling of skin and loosening of hair.
- ❖ Degloving
- ❖ **Degradation** – Anatomical integrity lost.
- ❖ **Dissolution** – Liquefaction of tissues and organs.

Colliquative putrefaction

- ❖ It occurs after attainment of maximum swelling due to gas accumulation; body begins to shrink due to the escape of gases. This Colliquative putrefaction occurs in 5-7 days after death.
- ❖ This is due to liquefaction of tissues; the soft tissues begin to detach from the bones.
- ❖ The lungs collapse and heart and other soft tissues softened.
- ❖ Liver, spleen, kidneys and intestines and other soft tissues become soft, loose and are converted into semisolid black pultaceous mass.
- ❖ Prostate and non-gravid uterus resist putrefaction for a long time.

Conditions affecting putrefaction

1. **Temperature:** Rate of putrefaction is high in the temperature between 21 and 38°C. It is arrested below 0°C and above 48°C.

2. **Moisture:** It is necessary for decomposition; rapid drying arrests decomposition.

3. **Clothing:** Initially covering of the body hastens putrefaction by maintaining temperature. Later the fluid formed is absorbed and body becomes dry. This happens in confined bodies.

4. **Conditions of the body:** Fatty and flabby bodies decompose easily as fat preserves heat.

5. **Cause of death:** The body of persons dying from septicemia, peritonitis, inflammatory and septic conditions decompose rapidly.

Some poisons like carbolic acid, phosphorus, arsenic, thallium, antimony and other metallic poisons, strychnine cyanide CO and datura, delay putrefaction as they have preservative elements.

6. **Environment:** In which the body is lying:

Casper's dictum

Air (1)	Water (1/2)	Deep burial (1/8)
Decomposition	2 times slower	8 times slower

- In a deeply buried body, it takes 8 months to 1 year for skeletonisation.
- In water, the decomposition is slower, but when the body is taken out the decomposition becomes faster.

Modifications of Putrefaction

In unfavourable conditions, putrefaction is arrested and modified into—

1. Adipocere
 2. Mummification
- ❖ Adipocere is a late change after death, in which the body fats are converted into fatty acids, and a wax like material (adipocere) is formed.

Adipocere



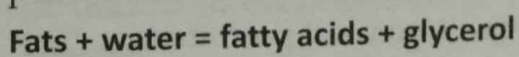
- ❖ It is a modified form of putrefaction.
- ❖ Conditions needed: Warm climate, humid and anaerobic environment, like bodies buried in damp graves, bodies immersed in water/mud, or bodies in water-filled coffins.
- ❖ Cold weather retards and hot weather accelerates adipocere formation.

Properties

- ❖ Appearance: The fresh adipocere is moist, soft, translucent, whitish and waxy. Later it becomes dry, brittle, cracked and yellowish.
- ❖ Smell: In early stages, it is penetrating rancid/ ammoniac odour.
- ❖ Floats on water
- ❖ Inflammable: It burns with faint yellow flame.

Mechanisms

- ❖ It is due to hydrogenation and hydrolysis of body, fats occur in presence of water and heat.
- ❖ *Chlostridium perfringens* produce lecithinase which facilitates the reaction.
- ❖ Main component of adipocere is palmitic acid.



- ❖ The fatty acids and glycerol form insoluble soaps, since the insoluble soaps are acidic in nature they inhibit putrefaction bacteria. It further favours adipocere formation.
- ❖ The concentration of fatty acids increases with time.
- ❖ **Role of water:** The process of adipocere formation utilises and consumes internal water in the cells and body fluids. So the body becomes more and more dehydrated. This dehydration caused by consumption of water slows the growth of putrefactive bacteria.
- ❖ **Sites of Adipocere formation:** Fat rich tissues like female breasts, cheeks, face, chest abdomen buttocks and limbs.
- ❖ It rarely involves the whole body and is limited usually to some regions of the body.
- ❖ **Time taken:** It may start within 3 days and persist for years.

MLA

1. Facial features are well preserved and it helps in establishing identity.
2. The cause of death can be determined because injuries are preserved and can be recognised.
3. Time since death can roughly be estimated.
4. Place of disposal of body can be known.

Mummification

- ❖ It is the late change after death and is a modified form of putrefaction.
- ❖ Drying, shriveling and desiccation of the body tissues occur after death due to evaporation of water.
- ❖ So the body becomes very thin, shrunken, contracted, leathery and stretched tightly across anatomical prominence.



- ❖ Dry and hot environment; e.g: desert, air heated buildings and burial in shallow graves in dry sandy soil accelerates mummification.
- ❖ Time taken: 3 months – 1 year
- ❖ Chronic arsenic and antimony poisoning favour mummification.
- ❖ Mummified body is odourless.
- ❖ **Fate:** The dried tissues start to split powdery and disintegrates.
- ❖ Slight adipocere formation is common in mummification.

MLI

1. Identification is possible due to preserved body parts.
2. Injuries can be understood to an extent.
3. Rough idea about time since death can be understood.
4. Some idea about place of disposal can be understood.

(see table on next page)

19.3 Medico-legal Autopsy and Exhumation

Autopsy, necropsy or postmortem examination is the examination of body after death.

Types of autopsy

1. Pathological autopsy (clinical autopsy)
2. Medicolegal autopsy
3. Anatomical autopsy

Features	Adipocere	Mummification
Cause	Conversion of body fats to fatty acids	Drying and desiccation and dehydration
Moisture	Gains moisture	Loses moisture
Smell	Rancid smell	odorless
Ideal condition	Warm humid anaerobic conditions	Hot and dry like deserts
Bacterial activity	Yes	No
Time required	3 days	3 months-1 year
Favored by	Not so	Arsenic and Antimony poisoning

Pathological autopsy (Clinical autopsy)

- ❖ Performed in case of death due to natural causes, in order to ascertain the exact cause of death.
- ❖ It is done by a pathologist and consent of the nearest relative is essential.

Medicolegal autopsy (Forensic autopsy)

- ❖ It is done in case of unnatural deaths.
- ❖ It is done to find out the cause, manner and time of death.
- ❖ It is performed only on the instructions of a legal authority, usually police officer (IO) or magistrate.
- ❖ Consent from the relative is not required.
- ❖ It is usually done in mortuaries.

Anatomical autopsy

- ❖ It is done to study or learn normal structure of human body.
- ❖ It is usually done in unknown and unclaimed dead bodies or bodies donated by relatives of the deceased for this purpose.
- ❖ It is usually done by an anatomist.

Others

1. **Psychological autopsy:** This is not really an autopsy at all, but a perusal of medical and personal history and other background information of a deceased

person who had committed suicide, to arrive at the motive of the act.

2. **Endoscopic autopsy:** This is done in case conventional autopsy is difficult to be done. Postmortem endoscopic examination can be performed with the help of a trocar and telescopic device along with a video camera. But this has many limitations.

3. **Virtopsy (Virtual autopsy):** In western countries, modern cross sectional imaging techniques are used to supplement and even partially replace traditional autopsy. CT scan and MRI are commonly used.

Objectives of Medicolegal autopsy

1. To identify the cause and manner of death.
2. To identify the deceased if unknown
3. To assess the time of injury and death
4. To collect evidences from the body to prove or disprove the guilt or innocence of an individual.
5. To document the injuries or lack of them.
6. To deduce how the injuries have occurred.
7. To document the pursues of any natural disease.

8. To determine or exclude any contributory or causative factors in the death.
9. To provide expert testimony if the case goes to trial.
10. In case infanticide, to decide whether the infant was born alive.

Rules of Medicolegal autopsy

- ❖ Every registered medical practitioner who is called upon to undertake a medicolegal autopsy is legally obliged to do it in **early possible time**.
- ❖ **No fee** is charged.
- ❖ **Permission or authorisation:** In India, police officer or magistrate can give authorisation for conduction of autopsy in case of sudden, suspicious and unnatural death; relatives consent is not required.
- ❖ Whenever a body is sent for autopsy, a *dead body challan* and *inquest report* should be there.
- ❖ *Dead body challan:* Is a formal requisition submitted to the medical officer by IO for conducting autopsy. It must contain name, address, age, sex and religion of the dead.
- ❖ It also contains the time, location, from where the body was recovered, distance from the site to the mortuary, name and address of the police officer and the relative accompanying.
- ❖ The medical officer should fill the column indicating the time of receipt of the dead body and time of commencement of autopsy.
- ❖ **Inquest (panchamnama):** It is the preliminary investigation report of the investigating police officer. It contains available history, details regarding injuries and provisional opinions of IO as well as 2 or more respectable inhabitants.
- ❖ **Place:** Normally is conducted in well-equipped mortuary, but as per conditions it can be done at the place where the body is found magistrate's order (in exhumation and mass disaster cases).
- ❖ **Time:** Normally it is done in day time, otherwise colour changes relating to bruise, jaundice etc. can be missed (in special case, it can be performed is night also)
- ❖ **Treatment and hospital record** should be submitted by IO as per the request of the performing doctor. By studying the history, the doctor can avoid unnecessary investigations.
- ❖ Before the autopsy, the body must be **identified** by the police officer. In case of unidentified bodies, photographs, and fingerprints should be taken by the police.
- ❖ Medical officer must **ascertain the circumstances** surrounding the case before, conducting autopsy. He must go through the inquest reports and treatment history thoroughly.
- ❖ Number of people present in the mortuary room should be limited. Not only there is a greater risk of loss of confidentiality, also hampers movement, causes distraction, and increased risk of infection and contamination.
- ❖ If the dead person was under medical care before death, **the physician** concerned should be allowed to be present at the autopsy as he knows relevant medical history.
- ❖ All the persons present in the autopsy room **should be listed** and named by the medical officer in a separate register or in the autopsy report.
- ❖ **Detailed notes** must always be made at the time of autopsy. The physician can dictate it to a junior and later he must verify the

notes and sign it, Sketches of all injuries should be made.

❖ **Verify injuries:** All the injuries mentioned in the inquest report must be verified if present or absent.

❖ **Number of doctors:** In most cases a single registered medical practitioner empowered by the state govt. is required to perform medicolegal autopsy. But if requested by the magistrate as in dowry death cases, and custodial death cases, a team of 2 doctors may be required to perform autopsy.

❖ As per the recommendations of **National Human Rights Commission**, all autopsies in case of death occurred in custody or prison have to be videotaped. The arrangements have to be made by the police.

❖ **Visit to the scene of crime:** This can be done by the doctor without delay in case of murder, poisoning, traffic accidents, sex crimes and firearm injuries.

❖ The body should **never be embalmed** before autopsy as it alters the toxicological evidences.

❖ Every medicolegal autopsy must be **thorough, meticulous and complete**. A partial autopsy should never be done.

❖ The information obtained through autopsy is **not privileged**. Hence, doctor conducting autopsy can divulge all the relevant information to the IO.

❖ The PM report should ideally be submitted within 24 hours of completion of autopsy.

Instruments for Autopsy

- ❖ Scalpel and disposable blades (22 size)
- ❖ Toothed forceps
- ❖ Rib cutters
- ❖ Councilman rib shears
- ❖ Stryker saw

- ❖ Chisel, skull breaker
- ❖ Hammer with hook
- ❖ Enterotome
- ❖ Dissecting scissors
- ❖ Brain knife
- ❖ Hagedorne's needle for sewing

Procedure

External Examination

Clothing:

- ❖ Any tears, bullet holes, loss of buttons, blood stains, seminal stains and other stains.
- ❖ Any foreign material, fibres, foreign hairs collected and preserved carefully.
- ❖ Cloth should be removed carefully and handed over to the police.

Height and Weight

- ❖ It is measured.
- ❖ General conditions of the body, sex, age, any colour changes, ptechia, skin rashes, scars, etc. are noted.

General description

- ❖ Colour, race, build deformities, hair, tattoo marks, moles, circumcision, etc. are noted (unidentified bodies).
- ❖ Edema of limbs,, surgical emphysema, skin rashes and eruptions are noted.

Natural body orifices

- ❖ Ears, nostrils, mouth, urethral openings and vagina should be examined for any discharges and injuries.
- ❖ Vagina should be examined. Vaginal swab, anal swabs and smear are collected in suspected sexual assaults cases.
- ❖ Presence of mud, blood, saliva, vomitus, faeces, corrosives and other poison or gun powder is noted.

Eye

- ❖ Conjunctiva, sclera, corneal opacity, artificial eye, contact lenses, tache noire, sub-conjunctival; haemorrhages and black eye should be noted.
- ❖ Lips and inner aspects of teeth are examined.

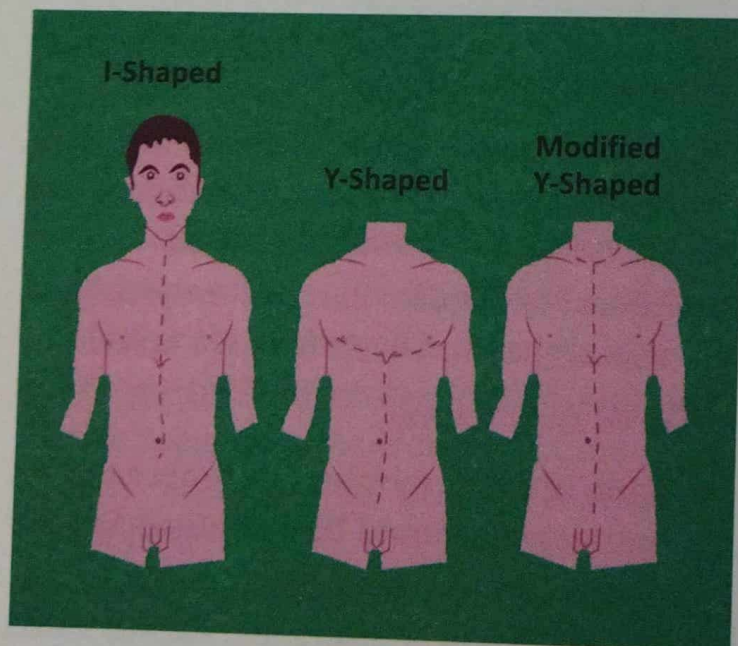
Body temperature

- ❖ Body temperature can be measured by inserting chemical thermometer in anterior abdominal wall.

Rigor mortis: Its establishment and passing from various parts should be described.

PM staining or hypostasis: Its presence on various parts of the bodies, and whether it is fixed or not and colour changes should be noted.

Each injury on the body: The nature and exact position should be described. All the injuries should be numbered. It should be marked with a diagram.

Postmortem incision

- 1. I-shaped incision:** Midline incision extending from the chin straight down to pubis avoiding the umbilicus.
- 2. Y-shaped incision:** From xiphisternum to either side, under the breast extending

up to acromion and xiphisternum and a midline incision to the pubis.

- 3. Modified Y-shaped incision:** From the mastoid process to the supra sternal notch, and from supra sternal notch midline incision downwards.

Internal Examination**Chest**

- ❖ The muscles of the chest should be dissected keeping the blade of the knife, directed inwards towards the ribs. Ribs should be exposed.
- ❖ Cases of pneumothorax should be demonstrated before opening of chest cavity.
- ❖ Ribs and sternum should be examined for any fractures.
- ❖ After opening the chest cavity, pleural cavity should be examined before complete removal of sternum to prevent leakage of blood to the cavity.

Abdomen

- ❖ Abdomen is opened cutting the muscles of anterior abdominal wall on midline.
- ❖ Removal of organs from abdomen.
 - **En masse (letulle's):** This method involves removal of most of the internal organs in one full swoop.
 - **Virchow's method:** This method of evisceration is simply, the removal of individual organs one by one.
 - **En bloc removal (Gohn's method):** this is the en bloc removal of viscera into thorax, intestines, upper abdomen, lower abdomen, neck and brain. Gohn developed this method and most widely used in UK.
 - **Rokintasnky's method:** This method uses in situ dissection with little evisceration. It is used in bodies with

highly transmissible diseases like HIV and hepatitis B.

In India usually modified Virchow's method is used.

Neck dissection

- ❖ Neck should be the last structure to be dissected in asphyxia deaths.
- ❖ Y-shaped incision is used to dissect the neck thus expose wide area at the front and sides of the neck, especially in hanging and strangulation uses.
- ❖ Layerwise dissection of neck is carried out to inspect the structures of neck.
- ❖ Following layers are inspected: (1) Platysma (2) Sternocleido mastoid (3) Omohyoid (4) Sternohyoid (5) Sterno thyroid and thyrohyoid.
- ❖ *Things to be noticed: Haemorrhages into the soft tissues, fractures of hyoid bone and thyroid cartilage, injuries to carotoid arteries and muscles.*

Head dissection

- ❖ Make a deep incision on the scalp along the vertex and reflect the scalp anteriorly and posteriorly.
- ❖ Notice any injuries or contusions.
- ❖ Sawing and removing the skull can expose the dura, check for any ante mortem thrombus.
- ❖ Remove the brain by inserting left hand fingers b/w frontal lobes, and skull and draw them back.
- ❖ Examine the remaining venous sinuses for ante-mortem thrombus.
- ❖ Then examine the brain, measure it, examine for any shrinkage or oedema and examine circle of Willis for aneurism, atherosclerosis, or embolism.

Preservation of viscera

In case of

- ❖ Suspected poisoning
- ❖ When unusual smell, colour, or an unidentifiable material is detected from stomach.
- ❖ Drug abuse
- ❖ Anaphylactic death
- ❖ Advanced decomposition
- ❖ Accidental deaths (RTA and machines death).
- ❖ Cause of death not found after autopsy.

Preservatives

1. **Saturated NaCl:** It is the most common preservative in India, cheap and easily available. It is indicated in all poisoning except corrosive poisoning, vegetative poisoning (aconite) and mercuric chloride. Corrosives should be preserved in rectified spirit.
2. **Rectified spirit:** It is the best and ideal method of viscera but it is less commonly used as it is costly and volatile in nature. It can be used in most of the poisoning cases except alcohol, kerosene, chloroform, ether, carbolic acid, formic acid, acetic acid and phosphorous paraldehyde.
3. **Anti-coagulant (sodium or potassium fluoride):** An enzyme inhibitor is added to blood, urine, CSF and vitreous humor when alcohol is to be estimated. It is used in cases of alcohol, cocaine, cyanide and CO.
4. **Urine analysis:** 10mg of thymol or sodium fluoride is added to 10ml of urine.
5. **Preservatives are not necessary:** When viscera is analysed in 24 hours, when sample can be kept in refrigerator, when the sample is bone, hair, or nail and

when lungs are preserved for detecting inhaled poison.

6. Viscera should not be put in formaldehyde:

It is because extraction of poison especially non-volatile organic compounds becomes difficult.

Exhumation (CrPC 176)

- ❖ It is the lawful digging of an already buried body (corpse) from the grave.

Purposes

1. Identification: The deceased in civil cases, insurance, accidental death claim, workmen's compensation and disputed paternity.
2. Death due to following reasons in criminal cases: Suspected homicide disguised as suicide, criminal negligence, criminal abortion, recovering bullets from dead body in firearm cases, and poisoning.
3. For doing second autopsy when first autopsy report is doubtful, or has not been done properly.
4. When the body has been disposed without autopsy and then after burial foul play is suspected.
5. To determine cause of death, time since death and manner of death.

Requirements

- ❖ **Written order:** A first class magistrate, district magistrate, sub-divisional magistrate or executive magistrate can order. Police cannot order for exhumation.
- ❖ **Supervision of magistrate:** The digging out of a buried dead body has to be done under the supervision of magistrate. The police officer and medical officer have to be present during exhumation.
- ❖ **Time:** It should be done early in the morning to avoid public exposure and sunlight increases the putrefaction rate.

- ❖ **Screening of that area:** The area should be screened off from public.
- ❖ **Identify the spot of burial:** The spot of burial has to be identified with the help of relatives or the persons related with the disposal. Grave has to be noticed from a fixed object like road, or tree.
- ❖ **Photography and sketching:** Photographs are taken from the very beginning of the procedure till end. Sketches may draw about the position of coffin and body.

Digging out of body

- ❖ Removal of earth in layers
- ❖ Lifting out of body carefully to avoid artefacts
- ❖ Identification of body by relatives
- ❖ Note the condition of soil and water
- ❖ Collection of soil: About ½ kg of soil should be collected from above, lateral sides and below the body for chemical analysis in suspected poisoning. The soil from control site should be collected.

Autopsy procedure

- ❖ Ideally the autopsy should be conducted in mortuary. If autopsy is conducted in the open near the graveyard it should be screened off from the public.
- ❖ Note the injuries and interpret them correctly; if only bones are found, arrange them in anatomical position.
- ❖ If nothing specific is found, hair, soil, teeth and bone have to be preserved.
- ❖ About ½ kg of soil, collected from the top, sides, bottom of the body should be kept in dry clean bottles for toxicological analysis.
- ❖ Time limit: Though there is no time limit for exhumation in India, the period is restricted to 10 years, 20 years and 30 years in other countries.

19.4 Transplantation of Human Organs and Tissues Act (THOA) 1994 (Amended In 2011)

Purpose

To regulate removal, storage and transplantation of human organs and tissues for therapeutic purpose and to prevent their commercial dealing.

Definitions

- ❖ Brainstem death: The stage at which "all functions of brainstem have permanently and irreversibly ceased".
- ❖ Minor-a person below 18 years
- ❖ Near relative: It includes 11 relationships: spouse; brother/sister; son/daughter; grandson/grand-daughter; father/mother; grandfather/grandmother,
- ❖ Transplantation: Grafting of many human organs or tissue, from any living/deceased person to some other living person for therapeutic purpose.
- ❖ A donor can authorise regarding organ donation before his death (he has to complete 18 years).
- ❖ Confirm death: Before removal of any human organ or tissue from the body, the doctor must examine the body and confirm death and brainstem death must be confirmed by 4 medical experts.
- ❖ Who will certify brainstem death:
 - Treating physician
 - Doctor in charge of the hospital
 - Neurologist (physician in the absence of neurologist)
 - Independent govt. doctor
 - Before removal of organ, it must be ensured that brainstem death has been certified.

- Organs removed from the body of a donor before death will be transplanted only to the near relatives.
- No organs shall be removed from the body of a minor or mentally challenged, before his death for the purpose of transplantation.
- If any donor authorises the removal of any of his organs after his death, the organs may be removed and transplanted into the body of any recipient who may be in need of such organs and tissues.
- If any donor authorises the removal any of his organs before his death for transplantation in the body of a recipient who is not a near relative, due to affection or attachment the organs shall be removed only with prior approval of authorisation committee.

Offences and Punishments

1. If any person removes human organs without permission of the authorities, punishment of 10 years jail and fine (20 lakh rupees) can be imposed; human tissues without approval of authority invites (3 years jail + Fine (Rs. 5 lakh).
2. If an RMP removes human organs: His name will be removed from the register, of council for 3 years for first offence and permanently for subsequent offences.
3. Punishment for commercial dealings in human organs is 5-10 years jail, + (20 lakh fine to 1 crore).
4. Punishment for illegal dealing in human tissues is 1-3 years jail and fine of Rs 5-25 lakhs.

Summary

Thanatology

The study of death and postmortem changes

Types of death

1. Somatic or clinical death
2. Molecular death or cellular death

Molecular or cellular death occurs 1-2 hours after somatic death.

Modes of death / Bichat's modes of death

- ❖ Dysfunction of respiration leads to asphyxia.
- ❖ Dysfunction of circulation leads to syncope.
- ❖ Dysfunction of brain function leads to coma.

Suspended animation

In this signs of life are reduced to a minimal level and resuscitation leads to survival. Causes are :

- ❖ Prolonged anesthesia
- ❖ New born babies
- ❖ Barbiturates poisoning
- ❖ Cholera
- ❖ Cachexia
- ❖ Concussion
- ❖ Drowning
- ❖ Electrocutation
- ❖ Hypothermia
- ❖ Hyperthermia
- ❖ Sunstroke
- ❖ Shock
- ❖ Trance (voluntary suspended animation is seen in yoga practitioners)

Postmortem changes

Immediate changes after death

- ❖ Insensibility and loss of voluntary power.
- ❖ Stoppage of respiration and circulation.

Early changes after death

- ❖ Eye changes & skin changes
- ❖ Algor mortis
- ❖ Livor mortis
- ❖ Rigor mortis

Late changes

- ❖ Decomposition / putrefaction
- ❖ Mummification
- ❖ Adipocere formation

Early changes

- ❖ Cornea loses its luster and become opaque
- ❖ Railroading phenomenon or trucking or Kevorkian sign: the retinal blood vessels appear segmented or fragmented. It can be seen using an ophthalmoscope few minutes to one hours after death.
- ❖ Flaccidity of the eyeball
- ❖ Tache noire: after death if the eyes are opened, dust is present in the atmosphere, it will get deposited in the sclera resulting in formation of brownish triangular shaped opacities. It occurs 3-6 hours after death.

Algor mortis

Post mortem cooling

- ❖ It starts 15 minutes after death. In this body temperature decreases. Thanatometer or a chemical thermometer is used to measure the temperature after death. Ideal place is the rectum. This helps to determine time since death.
- ❖ Postmortem caloricity: It is the raise in temperature after death or the body remains warm after 1-2 hours even after death.

Livor mortis or postmortem staining or Hypostasis

- ❖ The stain or coloration is present on the dependent part of the body due to the effect of gravity.
- ❖ This occurs due to the settling of blood in capillaries of dependent parts where close to the ground.
- ❖ Stain is absent where pressure applies (blanching).
- ❖ It begins shortly after death, visible in about 2 hours of postmortem. Maximum visibility occurs in 6-12 hours and fixation occurs after 6 hours.
- ❖ It helps to find out the time since death
- ❖ If body in supine position- then lividity is seen at back, if in the prone position lividity is in the front of the body, in hanging it is seen in the lower part of extremities and face.

Rigormortis or cadaveric stiffening or cadaveric rigidity

- ❖ It is the status of muscles after death.
- ❖ After death decrease in the ATP causes stiffness of muscles.
- ❖ It is seen in all muscles.
- ❖ It begins in 1-2 hours after death, first seen in myocardium. First external muscle affected is upper eyelid muscle.
- ❖ Order of muscles affected: eyelid muscles- neck- lower jaw-muscles of face-muscles of chest-upper limb-abdomen-lower limb-fingers and toes.
- ❖ In the first 12 hours rigor establishes, next 12 hours it persists, in last 12 hours rigor passes off.

Late changes

In this body gets decomposed by 2 mechanisms :

1. Autolysis
2. Putrefaction

Autolysis

- ❖ It is process where the body enzymes causes cell lysis.
- ❖ Clouding of cornea: first external autolytic change after death.
- ❖ Changes in the brain glandular tissue: 1st internal change.
- ❖ Aseptic autolysis involves mummification foetus in uterus.
- ❖ Putrefaction
- ❖ Three changes seen in putrefaction
- ❖ Colour change
- ❖ Gas formation
- ❖ Liquefaction of tissues

Modification of putrefaction and adipocere formation

Adipocere formation/grave wax/saponification

- ❖ Here fats in the body gets converted to fatty acids and combines with calcium in the body and forms insoluble wax like substances. It is the hydrogenation and hydrolysis of body fats.
- ❖ Adipocere formation preserves the body for a long time.
- ❖ Fresh adipocere is greasy and it look like rancid butter.
- ❖ Old adipocere : dry, hard, yellow and brittle.
- ❖ Time required for the formation of adipocere is : 3 days to 3 months, and it is absent in fetus less than 7 months.
- ❖ Helps to find out the time since death, cause of death.

Mummification

- ❖ It is a modification of putrefaction process characterized by the desiccation or dehydration of the cadaveric tissues.
- ❖ The skin of the deceased becomes brown, hard, and brittle and has stretched

appearance over prominences like the zygomatic bones, mandibles etc.

- ❖ Helps to determine the time since death and cause of death.

Exhumation

- ❖ It is the lawful disinterment or digging out a body from a grave which has already been buried.
- ❖ It is mentioned in CrPC 176
- ❖ It is done usually for the purpose of identification, to find the cause of death, to collect evidences.
- ❖ District magistrate sub divisional magistrate/executive magistrate are empowered to order for the exhumation.
- ❖ Carry out the autopsy in the morning in natural light.
- ❖ All evidence material should be collected, visceral samples are also collected for chemical analysis.

Autopsy

- ❖ It is the medical examination of a body after death to determine the cause & manner of death and to evaluate any disease or injury that may be present.
- ❖ It is usually performed by a specialized medical officer called a pathologist.

- ❖ Rules are: authorization, identification of the body, visit the scene of crime, history of the case, verification of the injuries noted by the police, examination of the body, notes, preservation of the viscera and other tissues.

The Transplantation of Human Organs and tissues Act (THOA) 1994

Aim

- ❖ Regulation of removal, storage, and transplantation of human organs for therapeutic purpose.
- ❖ Prevention of commercial dealings in human organs.
- ❖ Illegalizes the buying and selling of human organs and makes **cash for kidney** transactions a criminal offence.
- ❖ Establishes institutional structure to authorize and regulate human organ transplants and to regulate through regular checks, hospitals that are permitted to perform transplants.
- ❖ Recognizes for the first time in India the concept of brain stem death, paving the way for a cadaver based kidney transplant programs.

Important Questions

MCQ

1. Which IPC section defines death?

- | | |
|----------|----------|
| a. S. 44 | c. S. 54 |
| b. S. 46 | d. S. 51 |

2. Which one is not in Bishop's tripods of life

- | | |
|----------------|--------------------|
| a. Circulation | c. Excretion |
| b. Respiration | d. Brain functions |

3. Postmortem calorificity is seen in all except

- a. Barbiturates poisoning

b. Tetanus

c. Strychnine poisoning

d. Pontine hemorrhage

4. Earliest sign of putrefaction is

a. Marbling

b. Protrusion of eyes

c. Green colouration in right iliac foss

d. Blisters

5. March of 12 is observed in

- a. PM caloricity
- b. Algor mortis
- c. Livor mortis
- d. Rigor mortis

6. Postmortem lividity is fixed in

- a. 6 hrs
- b. 12 hrs
- c. 18 hrs
- d. 36 hrs

7. Sturners formula is

- a. ATP use in muscles
- b. Amount of K⁺ ion in vitreous humor after death
- c. Time since death of algor mortis
- d. Heat production of human body

8. Which enzyme has good role in putrefaction

- a. Lecithinase

b. Trypsine

c. Chymotrypsine

d. Amylase

9. Last organ to putrefy is

- a. Kidney
- b. Liver
- c. Heart
- d. Non gravid uterus

10. Rigor mortis first appears in

- a. Upper limb
- b. Eye lids
- c. Pancreas
- d. jaw

Answer key

1. b	2. c	3. a	4. c	5. d
6. a	7. b	8. a	9. d	10. b

Learning Objectives

- Describe death, stages, modes and postmortem immediate changes.
- Describe algor mortis, livor mortis and rigor mortis.
- Describe the decomposition or putrefaction, mummification and adipocere formation.
- Define autopsy, its rules and objectives and describe exhumation.
- Describe Transplantation of Human Organs Act.

Important SAQ

- Define death.
- Write a note on classification of death.
- Write a note on criteria for brainstem death.
- Explain exhumation.
- Explain Immediate changes after death.

Important LAQ

- Write about early changes after death.
- Describe liver mortis and its medicolegal significance.
- Write about rigor mortis and its medicolegal significance.
- Explain THOA.
- Write about adipocere and mummification.

Asphyxial Death

Asphyxial Death

Asphyxial death occurs when the body is deprived of oxygen leading to tissue damage and eventually death.

Mechanical asphyxia

It happens when an object or physical force stops you from breathing. It also includes body positions which prevent breathing. (See the table next page)

Classical signs of Asphyxia

1. Oedema congestion of organs
2. Petechial haemorrhages
3. Cyanosis

Oedema congestion of organs



When neck is compressed (as in hanging and strangulation), the venous return gets obstructed. This leads to congestion; face, lips and tongue become swollen and red. Sometimes there is darkening due to cyanosis.

Petechial haemorrhages



Due to the impaired integrity of capillary walls, RBC escape through, small bleeding points varying from pinpoint to pinhead size. These are known as Tardieu spots, patechia. This is most commonly seen in sclera, conjunctiva, pleura and pericardium. If the bleeding points are larger it is called ecchymosis.

Classification of Mechanical asphyxia

Hanging	Strangulation	Suffocation	Drowning
On the basis of degree of suspension of body • Complete • Partial	• Ligature • Manual • Palmar • Mugging • Bandsdola • Garroting	• Smothering • Gagging • Choking • Traumatic asphyxia • Wedging • Positional asphyxia • Overlaying • Burking	1. Typical (wet drowning) • Fresh water • Sea water 2. Atypical (dry) 3. Shallow water drowning 4. Immersion syndrome (hydrocution) 5. Near drowning 6. Secondary drowning
On the basis of 'position of knot' • Typical • Atypical			
On the basis of manner of hanging • Suicidal • Homicidal • Accidental • Judicial • Autoerotic hanging			
In relation to death • Ante mortem hanging • Postmortem hanging			

Cyanosis



The colour of oxygenated blood is normally scarlet red. When hemoglobin is not fully saturated with oxygen, that is if it is reduced it assumes a blue colour. This is known as Cyanosis.

Non-specific Signs

1. Abnormal fluidity of the blood.

2. Dilatation of right chambers of the heart, and great veins.

Specific Signs

- ❖ Ligature mark on the neck in hanging.
- ❖ Fingernail abrasions on the neck in manual strangulation.
- ❖ Fluid medium in the air passages and stomach in drowning.
- ❖ Foreign bodies in choking, gagging, etc.

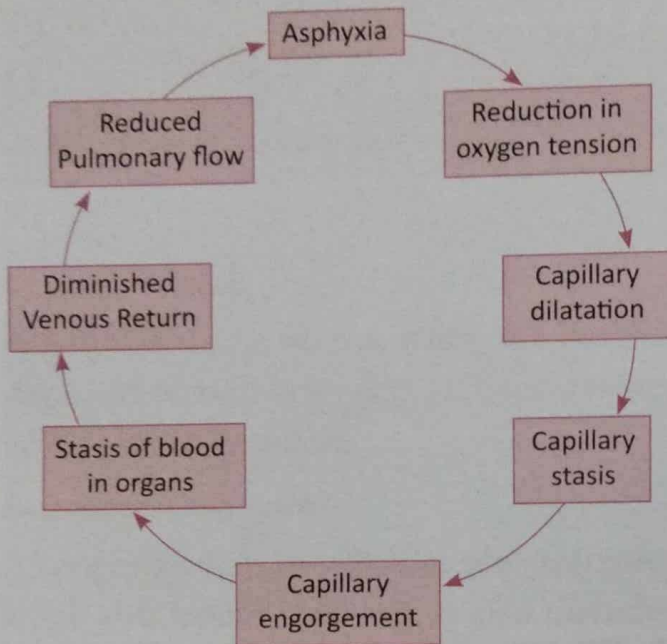
Anoxia is the lack of Oxygen

It is of 4 types —

1. **Anoxic anoxia:** It is lack of oxygen entering the lungs; e.g. it occurs in smothering, hanging, and strangulation.
2. **Anemic anoxia:** It occurs when the oxygen carrying capacity of blood is reduced. It occurs in haemorrhage, CO poisoning.

3. **Stagnant anoxia:** It occurs due to impaired circulation or stagnation, cardiac failure, embolism and shock.
4. **Histotoxic anoxia:** It occurs when tissue utilisation of O_2 is impaired as in cyanide poisoning.

Asphyxia- vicious cycle



20.1 Hanging

Hanging is a form of mechanical asphyxia caused by suspension of body by a ligature, tied around the neck, and the constricting force being the weight of the body, (in

complete hanging) or weight or part of the body (in partial hanging). Compression of neck causes death.

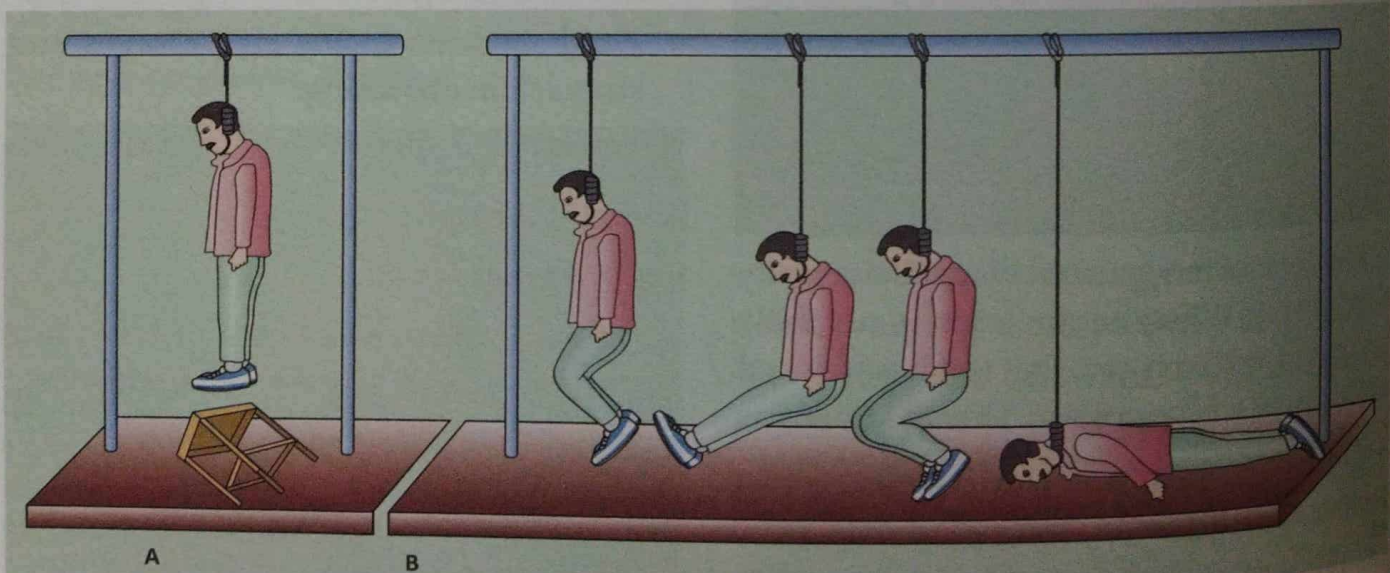
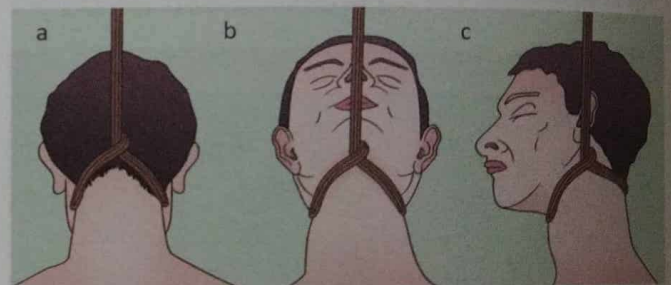
Types of Hanging

On the basis of "degree of suspension of the body", types of hanging:-

1. **Complete hanging:** The body is completely suspended in the air (i.e. the feet do not touch the ground) and the constricting force is the weight of the body.
2. **Partial (incomplete) hanging:** The body is partially suspended that is any of the lower part of the body, (e.g.: feet, toes, knees, buttocks) touches the ground and thus the constricting force is only a part of the body weight. The body may be in partial standing, sitting, kneeling or reclining.

See the fig down

According to position of knot



3. **Typical hanging:** In this type of hanging, the knot of the ligature material is placed centrally at occiput.

4. **Atypical hanging:** A type of hanging in which the knot is placed at any other position apart from the occiput.

On the basis of manner of hanging

- ❖ Suicidal
- ❖ Homicidal
- ❖ Accidental
- ❖ Judicial hanging

In relation to death

- ❖ Ante-mortem hanging
- ❖ Postmortem hanging

Mechanism of Hanging

- ❖ Constriction force required to occlude various structures of neck :

Force	Structure	Effect
2kg	Jugular veins	Cerebral venous congestion
5kg	Carotid artery	Cessation of blood supply to brain
15kg	Trachea	Obstruction to respiration
30kg	Vertebral arteries	Cessation of blood supply to brain

Causes of Death

Immediate cause

- ❖ **Air way occlusion:** Prevention of entry of oxygen into respiratory passage.
- ❖ **Venous congestion:** The jugular veins are blocked and cause congestion.
- ❖ Combination of asphyxia and venous congestion.
- ❖ **Cerebral anaemia:** Arteries of the neck are blocked by ligature preventing oxygen supply to brain.
- ❖ **Vaso vagal inhibition:** This is due to baroreceptors of carotid sinus, carotid sheath, and carotid body which may results in bradycardia or cardiac arrest.

- ❖ **Fracture dislocation of cervical vertebrae:** Hangman's fracture occurs in between second and third cervical vertebra. (C_2 - C_3)

Delayed cause

- ❖ Infection
- ❖ Sequelae of hypoxia to brain
- ❖ Oedema of organs (lungs)

Symptoms of hanging

- ❖ There will be loss of power and intense mental confusion.
- ❖ Ringing noises in the ears.
- ❖ There may be flashes of light, followed by loss of consciousness; some times instantaneous death due to vasovagal inhibition
- ❖ It is considered as painless form of death
- ❖ Unconsciousness followed by convulsions
- ❖ Respiration stops first and after 10-15 minutes, heart stops
- ❖ **Fatal period:** 3-5 minutes

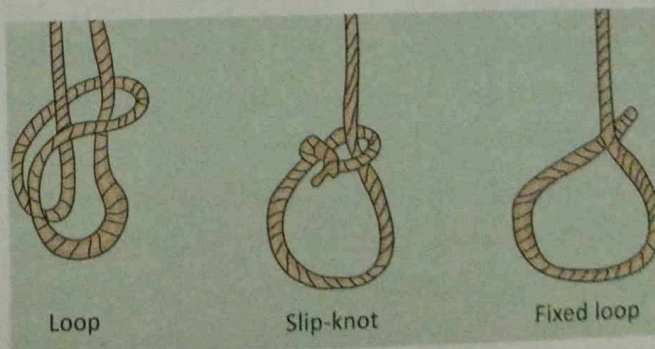
Autopsy Findings

Ligature material

- ❖ Any material can be used as a ligature material like rope, wire, electric cable, belt, dothi, saree, scarf, dupatta, etc.
- ❖ Cut the noose away from the knot

Types of knots

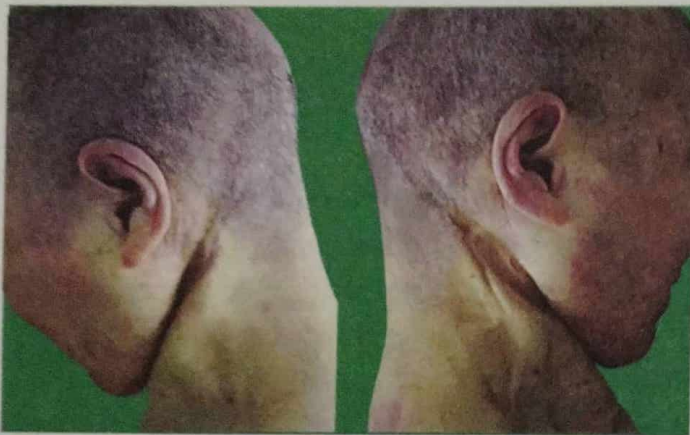
- Simple slip knot with running noose- most commonly used
- Fixed or granny knots



- ❖ Usual sites of knots are: Occiput, mastoid or mandibular angle and below chin

Ligature mark

- ❖ Ligature mark is a **pressure abrasion** and is oblique in hanging and does not completely encircles the neck.
- ❖ The mark goes obliquely upwards towards the position of the knot and this produces an inverted V shaped mark.



- ❖ Initially it is soft and pale but as the skin dries up, it becomes hard, parchment like, and dark brown.
- ❖ More thinner and tougher the material used, more prominent will be the ligature mark
- ❖ The ligature mark is usually seen above the level of thyroid cartilage or at the level of thyroid cartilage. Rarely it may be below the thyroid cartilage, especially in partial hanging.
- ❖ The mark is prominent and opposite to the knot.
- ❖ Sometimes the ligature material causes imprint of the pattern of the material.
- ❖ In partial hanging, the mark may be horizontal. If a flat belt is used for hanging, two parallel ligature marks, are produced as the upper and lower margins dig into the skin.
- ❖ Prominence of the mark depends on the time of contact with the ligature material. Less time of contact produces a feeble mark.
- ❖ The ligature mark may be absent at neck where beard or hair or cloth is present in between the ligature and skin.

- ❖ Ligature mark is less prominent and grooving is less on the back of neck due to firm muscular tissue.
- ❖ Ligature mark is exactly similar as in ante-mortem hanging generates while suspending the body within 2 hours after death
- ❖ In obese and infants, skin fold on the neck may resembles a ligature mark in hanging.

General findings

- ❖ Face pale and congested.
- ❖ Eyes are sunken.
- ❖ Head tilted to the side opposite to the side of knot and neck is stretched and elongated.
- ❖ Tardieu's spots (bleeding points) can be seen in inner eyelids.
- ❖ Eyes are closed or partially open and pupils are dilated.
- ❖ The knot of the ligature presses the cervical sympathetic ganglion, eyes on that particular side remains open and its pupil dilate (*le facie sympathique*). It is a sign of anter mortem hanging.
- ❖ Tongue may be protruded and bitten. The lips and mucus membrane of mouth are blue.
- ❖ *Dribbling of saliva*: There may be salivary trickle marks from one angle of mouth, opposite side of the knot. This is because ligature may press on the salivary glands causing increased salivation. This causes dribbling of saliva through the angle of mouth. If the body is viewed later it is seen as salivary stains from the angle of mouth on to the front of the chest. This is a conclusive sign of antemortem hanging.
- ❖ Engorgement of penis seen due to hypostasis and semen may be present at the tip.
- ❖ There may be urine and fecal discharge due to sphincter relaxation.

- ❖ If the body is suspended for a long duration, hypostatis is seen in the most dependent part, the distal end of extremities and lower part of face. This looks like *Glove stocking pattern*.

Internal findings

Neck should be dissected in a bloodless flap dissection method (blood less field); brain, skull cavity, viscera of chest and abdomen should be removed, to drain the blood from the vessels of neck.

- ❖ **Tissues under the ligature mark:** Usually the tissues are dry, white and glistening.
- ❖ **Sub cutaneous tissues and muscles:** Those may show haemorrhages
- ❖ Fractures of hyoid bone and thyroid cartilages are rare
- ❖ Hyoid bone fracture in 15%-20% cases; it is outward (antero-posterior compression/abduction) fracture; site between inner 2/3rd and outer 1/3rd
- ❖ Thyroid fracture is rare: If present it is of superior horns
- ❖ All internal organs (brain, heart, lungs and abdominal organs are congested); Tardieu's spots are present on lungs and heart.
- ❖ Bowel wall haemorrhage: it is a valid ante-mortem sign of hanging.

Medicolegal Aspects of Hanging

1. Suicidal Hanging

- ❖ Hanging is a very common method of suicide. There should be a platform for **complete hanging**, in which the feet do not touch the ground. **Partial hanging** where the body touches the ground and doesn't need any platform. Age and blindness are not a bar for suicidal hanging.

2. Partial Hanging (Incomplete Hanging)

- ❖ In partial hanging, lower part of the body touches the ground and the person is seen

in hanging, standing, sitting, kneeling, supine or in reclining position.

- ❖ In this type, full weight of the body does not act as the constrictive force
- ❖ Loss of power occurs in the initial stage so the person can't raise his hands for untying the knot.
- ❖ In partial hanging, congestion is, more than the constriction force. Even the carotid arteries are blocked the vertebral arteries continue to supply blood to brain; so the face will be more congested and petechial hemorrhagic spots are appearing
- ❖ Ligature mark less oblique and even horizontal

3. Accidental Hanging

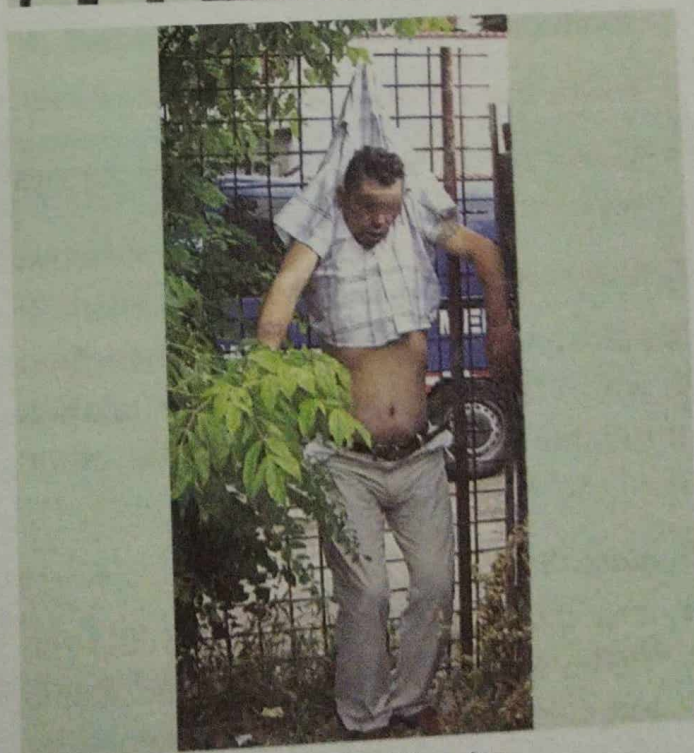


Fig: Accidental hanging

- ❖ This is commonly happen in children while playing
- ❖ Adults may also accidentally hung in steering wheels in RTA, chair, door, etc.
- ❖ Infants – accidental hanging occurs in cribs made of cloth.
- ❖ Death can accidentally happen in abnormal sexual behaviour is called sexual asphyxia.

4. Sexual Asphyxias

A. Auto Erotic Asphyxia

- ❖ This is also called auto-erotic asphyxia or asphyxiophilia. (Kotzwainism)
- ❖ In some people, partial asphyxia caused by partial obstruction of air passages may cause cerebral disturbances and hallucinations of erotic type.
- ❖ They produce partial asphyxiation to get more sexual pleasure during masturbation.
- ❖ The degree of asphyxia is controlled by mechanical means and death occurs accidentally.
- ❖ This is usually associated with sexual perversions transvestism and masochism.
- ❖ Victim, usually male, is found in his bed room or bath room

B. Plastic bag suffocation

- ❖ Covering of face in plastic bags causes asphyxia and later death.

C. Glue sniffing

It is also another sexual gratification method in which the victim dies due to inhalation of volatile substances such as glue, ether, amyl nitrite, paint thinners, etc.

5. Homicidal Hanging

- ❖ It is difficult to accomplish unless the victim is a child, or a weak and feeble individual, or one who is weakened by drugs or alcohol.



- ❖ **Lynching:** It is a form of homicidal hanging where a person, suspected to be involved in dacoity, murder, or rape is overpowered by a mob and hanged forcibly from a tree or lamp post.

6. Judicial hanging

- ❖ In some country including India, hanging is method of legal execution of death sentence.
- ❖ The condemned person is first led to the gallows, and his face is covered with a black mask. The noose is adjusted around his neck.
- ❖ He is then made to stand and a platform which by a lever is pulled back, so that the person drops down to 10-15 feet.
- ❖ While falling, when he comes to the end of rope, there is a violent jerk which causes a fracture dislocation of upper cervical vertebra (C_2-C_3) (**hangman's fracture**). C_3-C_4 is rarely affected. This disrupts the brainstem resulting in instantaneous death.
- ❖ In rare cases, there may be dislocation of atlano-axial joints and odontoid process jams against the spinal cord. In judicial hanging, the odontoid process is not usually fractured.

7. Postmortem Hanging (suspension)

- ❖ Occasionally after victim has been murdered, the body may be suspended, to simulate hanging in order to mislead

the police into believing it to be a case of suicide. Signs of asphyxia may not be prominent in this.

(See the table bottom)

20.2 Strangulation and Suffocation

Strangulation

It is a form of mechanical asphyxia, which is caused by constriction of neck by a ligature, without suspending the body. So in strangulation, the constricting force is anything other than the weight of the body.

Classification

1. Ligature strangulation
2. Manual strangulation
3. Palmar strangulation
4. Mugging
5. Bandsdola
6. Garroting

1. Ligature Strangulation

- ❖ It is the most common type of classical strangulation in which ligature material (rope, wire, cloth) is used to constrict the neck.



- ❖ The word strangulation usually means ligature strangulation.
- ❖ It may be homicidal or accidental.
- ❖ **Mechanism:** Due to Ligature-obstruction of trachea- blockage of jugular vein- cerebral venous congestion- anoxia – vagal inhibition-death
- ❖ **Ligature** Any type of materials tied around the middle of the neck, with a knot on front sides or back of neck.
- ❖ Knot may be single, simple or double knot or reinforced knot.

Ligature mark

- ❖ It is a pressure abrasion. It is horizontal and completely encircles the neck or below the thyroid cartilage.

Differences between Hanging and Postmortem Suspension

S.No	Features	Ante-mortem hanging	PM hanging or suspension
1.	Signs of asphyxia	Present	Absent
2.	Ligature mark	Dried, parchment like	Not so
3.	Subcutaneous tissues	White hard and glistening	Not so
4.	Salivary stain	Present	Absent
5.	La facie sympathique	Present	Absent
6.	Drag marks on the body	Absent	May be present
7.	Tongue protrusion	Present	Absent
8.	Rope fibres in the hands of victim	Present	absent
9.	Faecal, urinary, seminal discharge	Present	absent
10.	Cause of death	Asphyxia due to hanging	Asphyxia due to throttling, poisoning
11.	Suicide note	Present	Absent

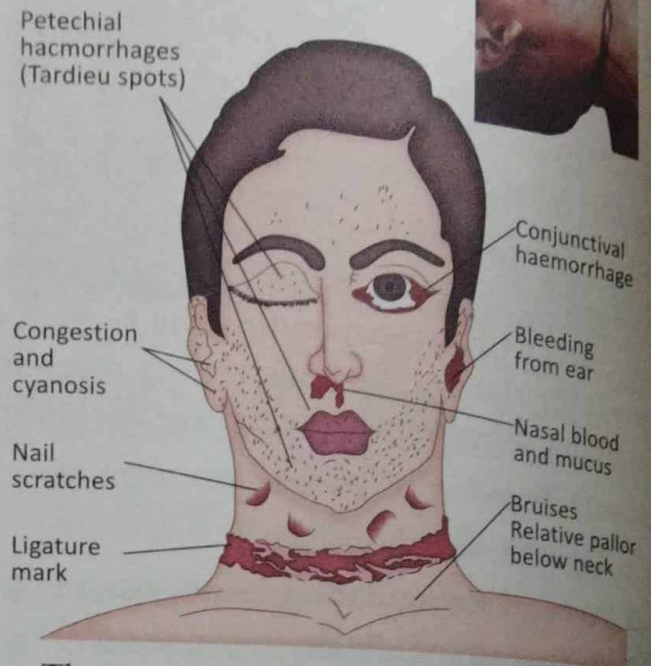


- ❖ In the absence of ligature material, a cellophane tape is pressed to get the fibres of the ligature material.
- ❖ There will be bruising on the margin of the ligature mark.
- ❖ The ligature mark is more prominent in the front and fades while moving backwards as tougher tissues are present in the back of neck.
- ❖ There may be a wider area of bruising mark in the position of knot
- ❖ The mark may be oblique if the victim is in a sitting posture, and the assailant is standing to pull the victim, up with the ligature, or the victim is dragged by the cord.
- ❖ Petechial haemorrhages is seen at the margins of the ligature mark.

General Findings-Autopsy

Face

- ❖ There may be intense congestion and cyanosis of the face.
- ❖ There is petechial haemorrhages called Tardieu's spots on face.
- ❖ Sub-conjunctival haemorrhages are seen.
- ❖ Bloody frothy discharge from mouth and nostrils.
- ❖ Tongue seen as protruded.
- ❖ Cyanosis of lips, tongue and finger nails may be seen.



- ❖ These signs are absent if death occurs suddenly due to vagal inhibition.

Other findings

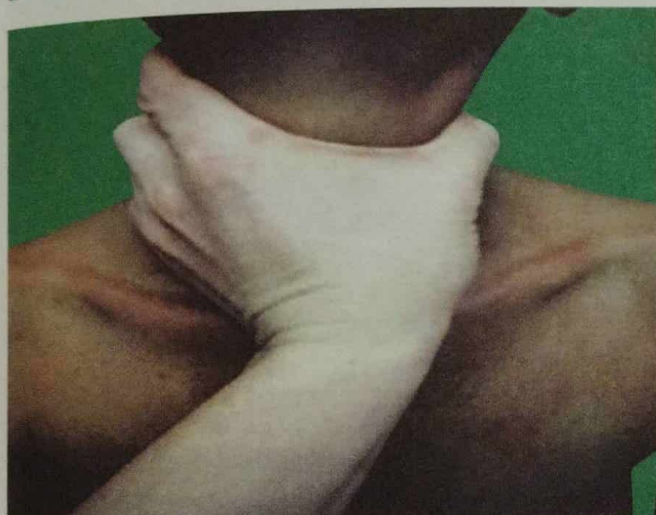
- ❖ There may be faecal, urinary and seminal discharges.
- ❖ Signs of struggle: In homicidal strangulations, there may be other injuries like abrasions, contusions in the neck, shoulder, etc.
- ❖ Sometimes cadaveric spasm occurs with a piece of button, hair or cloth may be seen grasped in the hand of assailant's hand.

Internal findings

- ❖ There may be haemorrhages under ligature mark.
- ❖ The strap muscles under the ligature mark shows bruises.
- ❖ Thyroid cartilage may show fracture, it may be antero-posterior compression fracture of superior horn or midline fracture of body of thyroid cartilage.
- ❖ The lamina of cricoid cartilage is fractured if a greater force is applied in strangulation.

- ❖ Hyoid bone fracture is not seen usually in ligature strangulation because of its higher position in the neck but may be fractured due to the stretching force of the thyro-hyoid ligament.
- ❖ Fractures are not usually seen in children due to the cartilaginous nature of these parts.
- ❖ Carotid intima tear may occur.
- ❖ Lungs: The lungs are intensely congested, with sub pleural petechial haemorrhages.
- ❖ Pulmonary oedema is present
- ❖ Brain: Congested and edematous
- ❖ All other internal organs are congested.

2. Manual Strangulation or Throttling



- ❖ Asphyxia produced by constricting the neck by hands is called manual strangulation or throttling.
- ❖ A person kills another by forcefully and violently, pressing his/her front of the neck by both hands.

General findings

- ❖ Death occurs mainly by occlusion of blood vessels.
- ❖ Most common victims are children, old people, sick or bed-ridden people. If the victims are healthy or young, signs of struggle can be seen.
- ❖ MLI: Homicidal throttling is most common form.

Autopsy Features

External

- ❖ Head and face are congested with petechial haemorrhage.
- ❖ Sub-conjunctival haemorrhages is present
- ❖ Tongue is protruded
- ❖ Neck: Bruising and abrasions are seen in neck due to struggle
- ❖ Place of bruises denotes the position of the assailant
- ❖ Involuntary discharge of faeces and urine.
- ❖ Evidences of struggle are also seen in other parts of the body.

Internal

- ❖ Tissues underneath the ligature mark: show haemorrhages
- ❖ Sub-cutaneous tissue, sternocleidomastoid muscles and other muscles shows haemorrhage.
- ❖ Fractures: Hyoid bone fracture is the most common in throttling as compared to hanging and ligature strangulation. It occurs in 30-50% cases in throttling. Most common type is inward compression fracture.
- ❖ Thyroid cartilage fracture: The fracture of superior horns/cornuae is common than lamina fracture.
- ❖ Carotid intima tear is present in 15% cases.
- ❖ All organs are congested. Lungs congested, edematous with sub pleural petechial haemorrhages brain shows petechial haemorrhages.

3. Palmar Strangulation

It is a combination of smothering and strangulation. One palm is placed horizontally across the mouth and nostrils. It closes the mouth and nostrils which causing smothering. The other palm placed in right angle to the hand causes smothering; so the

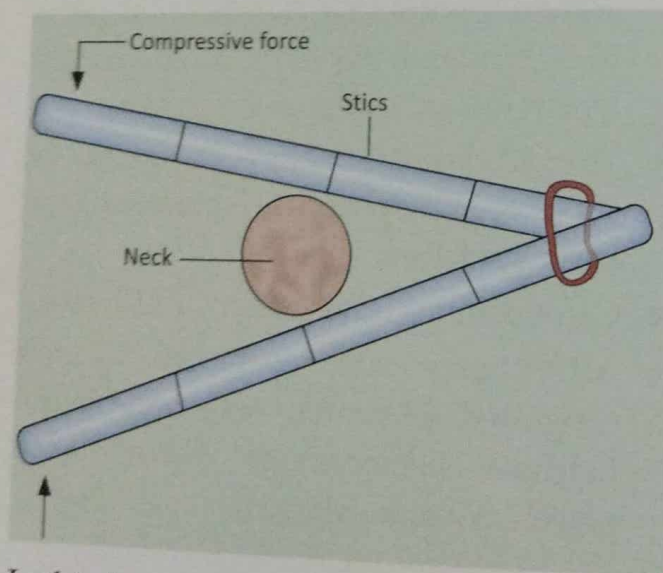
heel of the palm causes air way obstruction, causing strangulation.

4. Mugging



It is the strangulation caused by holding the neck of the victim in the bend of the elbow. This attack is made from behind. It can also be done with bend of knee.

5. Bandsdola



In this form of strangulation, a wooden pole or rod is placed over the front of and another behind the neck. One end of these rod is fastened together by a rope. The other ends when forcefully brought together squeeze the neck to cause death.

6. Garroting

This was a method of judicial execution in some countries. The victim is made to wear a neck collar of metal. Death is brought about by tightening the collar. Since there is an upward pull, the resulting ligature mark may resemble that of hanging.



Medicolegal Importance of Strangulation

Manner of strangulation

Circumstances of Death

1. **Homicidal strangulations:** This is most common among female victims and commonly associated with sexual crimes. The law presumed that all strangulations are homicidal unless contrary is proved. Along with marked signs of asphyxia, signs of struggle are present: Bruising of the neck, abrasions of neck (nail marks- if ligature strangulation associated with manual strangulation), and bleeding from internal tissues of neck.
2. **Accidental strangulation:** It is rare, but it may occur when an article of clothing, such as a dupatta, neck band or cord, gets tightly drawn, around the neck,

in an abrupt manner. It is commonly occurs usually in children, adults under intoxication of drugs or alcohol, and new born babies, who accidentally get strangled by the umbilical cord.



3. **Suicidal strangulation:** Suicidal strangulation is rare. Because once anoxia gets sets in, the pressure over the neck gets relaxed. In rare cases of suicidal

strangulations, multiple turns are made around the neck, with a single knot. It is effected successfully by strangulation, when the victim, manages to keep the ligature tight by knotting it, or twisting it sometimes employing stick as a lever.



Suicidal double ligature strangulation
(See the table down)

Differences between Hanging and Strangulation

Features	Hanging	Strangulation
Ligature mark	Oblique, above the level of thyroid cartilage, not encircling the neck completely	Transverse at or below the level of thyroid cartilage, completely encircle the neck, with crossing of the ligature mark
Injuries to neck structures	Pale look of the tissues under the ligature mark, bruising of neck muscle is less common	Bruising of neck muscle is more common
Hyoid bone fracture	Fracture may occur Antero-posterior compression fracture or abduction fracture	Ligature strangulation - Fracture is uncommon (but in throttling, inward compression fracture may occur)
Thyroid cartilage fracture	Fracture is less common	Fracture is more common
Larynx and trachea	Fracture is rare	Fracture may occur
Signs of asphyxia	Less prominent	More prominent
Bleeding	From ears, nose, and mouth is less common	From external orifices is more common
Saliva	Dribbling often present	Absent

Suffocation

Suffocation is a type of mechanical asphyxia caused by obstruction of the passage of air into the lungs. (Excluding constriction of the neck and drowning)

It includes

1. Smothering
2. Gagging
3. Choking
4. Traumatic asphyxia
5. **Wedging:** It means compression of the body within a narrow space. The chest wall movements are prevented, which leads to asphyxia.
6. Positional asphyxia (postural asphyxia)
7. Overlaying
8. Burking

Smothering

It is a type of asphyxia, caused by mechanical obstruction of external respiratory orifices (nose and mouth) by any means like hands, pillows, cushion, cloth, mud, cotton, bed clothing's, plastic bags, tape or any other soft material:

- ❖ Face congested and cyanosed with petechial haemorrhages.
- ❖ Pallor around mouth, and nose due to pressure applied. Pallor is less in children and old people as the resistance is less in them.
- ❖ Blood stained froth at mouth and nostrils.
- ❖ Injuries are present: Prominent if smothering done with hands.
- ❖ Nail marks: Seen crescentic marks, and linear abrasion may also be seen with violent movement of the head.
- ❖ Nose flattened with fractured nasal septum.
- ❖ Mouth: Contusions, lacerations, or earing of frenulum occur.

- ❖ Struggle marks on hands may be present, especially on wrist.
- ❖ Internal features: Organs congested with petechial haemorrhages.

MLI

- **Homicidal smothering:** It may be possible by pressing the external orifices in weak individuals.
- **Suicidal smothering:** It is very rare, A mentally retarded person or intoxicated person may cover his head by polythene bag or may or bury his face in bed clothing.
- **Accidental smothering:** It is the most common manner of smothering. It may occur in intoxicated adults with drugs or alcohol and infants. It happens by fall in mud, sand, grain, or plastic polythene bag on head (plastic bag suffocation).

Gagging

It is a type of asphyxia by forceful pushing or thrusting of a gag material (paper balls, piece of cloth, etc.) into the mouth, sufficiently deep to block the pharynx.

- ❖ Even if the cloth happens to be small, it partially blocks the air passages, soaks up saliva and swells. Due to constant foreign body irritation, there is pooling of saliva, and death subsequently occurs due to obstruction of air passages.

Autopsy features

- ❖ Face congested with petechial haemorrhages
- ❖ Gag may be found in the mouth
- ❖ If gag removed, abrasions of pharyngeal mucosa
- ❖ Marks of violence
- ❖ Internal organs are congested and edematous and show petechial haemorrhages

MLI

- Gagging is usually done at the time of **robbery** to make the victim unable to speak.
- **Homicidal gagging** is very common
- **Accidental gagging**: A false denture may block the air way from the pharyngeal level.

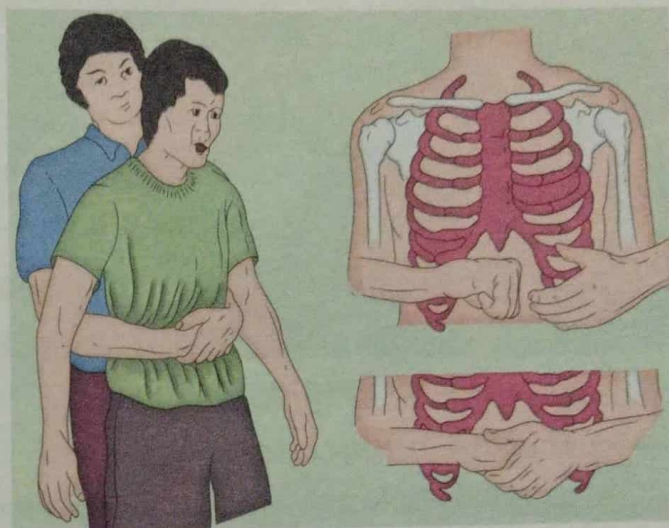
Choking

It is a type of asphyxia, caused by an obstruction within air passage, especially at just below the level of vocal cords.

- ❖ The materials usually choke include coins, dentures, fish bones, food bolus, seed and aspiration of vomitus.
- ❖ Death may occur due to neurogenic cardiac arrest or hypoxia.
- ❖ If death occurs due to asphyxia, classical signs like congestion, oedema, patchial and haemorrhages are seen.
- ❖ Death due to entry of blood into the airway in case of cut throat injury is also a choking.
- ❖ It is remembered that in order to cause obstruction of air passage, the object need not always be as large as the lumen of air passage. Even an object smaller in size than the lumen can cause a complete block because of reflex spasm of the respiratory passage.
- ❖ Choking occurs in following circumstances :
 - When power to masticate or swallow is impaired, e.g. very old, psychiatric patients.
 - Ingestion of food while laughing or crying or even talking or in drunken stage.
 - Vomit or regurgitated food in anesthesia or, mouth gag in dental operations or, natural diseases like diphtheria and pharyngeal abscess.

Management**Heimlich's manoeuvre**

The rescuer stands behind the patient and by his fist (made by interlinking fingers of both hand), he exerts upwards and backwards thrust in the epigastric region of the patient. It expels any foreign object obstructing the air way.



Cause of death: Choking is usually mechanical asphyxia. The foreign body may irritate mucosa to cause vagal inhibition of heart and laryngeal spasm, causing death.

Autopsy findings

- ❖ Signs of asphyxia present.
- ❖ Respiratory passage is congested and all other organs are congested and edematous.

MLI

- Choking is accidental; usually children put some foreign bodies while playing
- Suicidal rarely in psychiatric patients
- Homicidal choking is very rare
- Café coronary

Cafe Coronary

- ❖ This is the accidental entry of a bolus of food or food particles into the air passage obstructing the larynx and death is due to asphyxia and reflex vagal inhibition.

- ❖ This may happen when a person eating food in a restaurant and other people may think that death may occur due to heart attack, hence the name *Café coronary*.

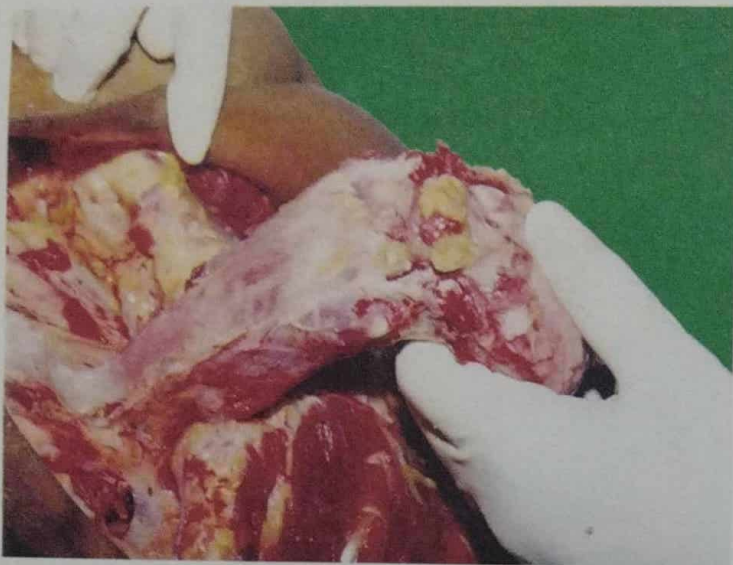


Fig: Food in air passage

Cause of Death

1. Accidental choking may occur in adult due to the depressed gag reflex if he is under alcohol.
2. Similar incidents may happen in mentally ill person who are under antipsychotic drugs.
3. It may occur in old people suffering with neuro-degenerative diseases (Parkinson's disease or Alzheimer's disorder).
4. In infants whose gag reflex has not developed.

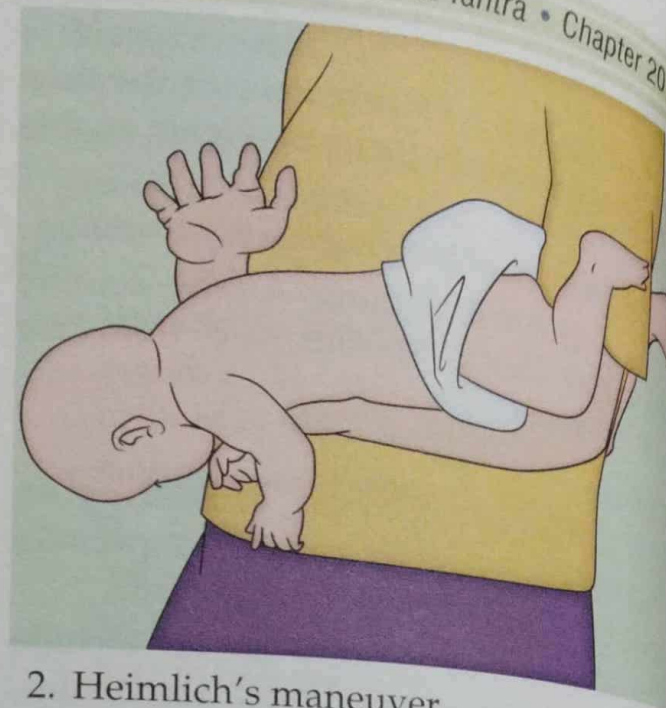
Causes of Death

1. Asphyxia
2. Laryngeal spasm
3. Vagal inhibition and sudden cardiac arrest

Management

First aid

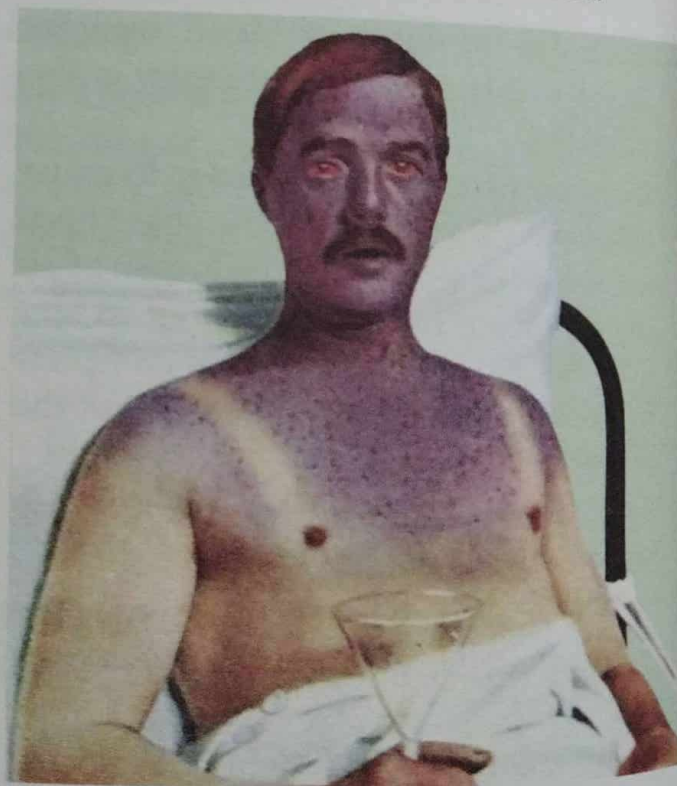
1. In case of choking in a baby, the baby has to be lifted by the legs up and one has to strike on the back of chest



2. Heimlich's maneuver

Traumatic Asphyxia

Asphyxia produced by mechanical compression of chest wall is called traumatic asphyxia. The normal movement of the chest wall is prevented in this condition.



Mechanism

- ❖ The essential feature is the fixation of thorax by severe compression or external pressure that prevents respiratory movements.

- ❖ Cerebral venous congestion occurs due to displacement of blood from superior vena cava to valve less veins of the head, neck and cerebral veins.
- ❖ Obstruction of venous flow from head and arms also causes cerebral venous congestion.

Causes

- Jack slip while working under a vehicle
- Steering wheel compression in Road Traffic Accident
- Landslides
- Building collapse
- Burying of a person in mud
- **Stampede:** When there is a great rush in the crowd, the chest of people are violently prefaced and weak persons collapse due to asphyxia or get crushed under feet.

Autopsy findings

- ❖ Gross congestion, cyanosis, and petechiae of the face, neck and shoulders are the most remarkable findings
- ❖ Very dark discolouration of the body above the level of constriction
- ❖ Instead of petechiae, haemorrhages are seen in the conjunctiva
- ❖ Copious bleeding may occur from ears and nostrils
- ❖ There may be injuries resulting from the heavy object pinning the chest
- ❖ Internally: Sub a pleural haemorrhages and Tardieu's spots are observed
- ❖ The right chambers of heart and the veins above the atria are markedly distended. The blood is forced back into the great veins due to pressure on the chest.

Overlying

- ❖ This occurs when parent or some other adult shares the same bed with an infant. During sleep he/she may unknowingly, roll over the infant asphyxiating it.
- ❖ Petechial haemorrhages are present with evidence of flattening of nose and face
- ❖ A clear pattern of the object (fabric) involved in compression is sometimes seen on the infant's cheek or body
- ❖ There may be blood-stained froth at the mouth and nose

Burking

- ❖ This is applied to asphyxia deaths resulted from someone sitting on another in a fashion that restricts breathing.
- ❖ The victim dies from asphyxia. In this type of mechanical asphyxia, movement of the chest wall is restricted to the point that breathing is not possible.
- ❖ William Burke and William Hare used this type of asphyxia method, in which they made their living by robbing dead bodies from the graves and supplying them to a medical schools for study. Later they killed 16 people.
- ❖ They would invite homeless people into their house offering them food and alcohol. When the victim was under the influence of alcohol they would throw them into ground. Burke would sit on the chest and smother the victim while Hare would hold the legs. Later they were caught and Burke was executed by hanging. In the judgment it was mentioned that his body would be given to medical school for dissection purpose and his skeleton is still preserved.



Fig: William brothers

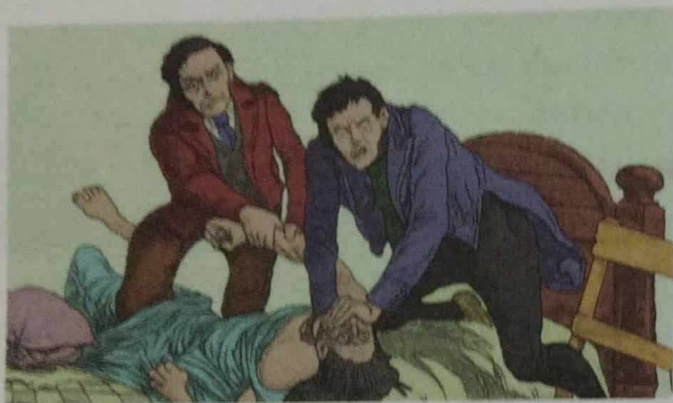


Fig: Burking combination of smothering and Traumatic asphyxia

Autopsy findings

1. Nail marks around the mouth and nostrils as evidence of smothering
2. Livid face and sub conjunctival haemorrhage
3. Rib fractures due to pressure on the chest
4. All internal organs congested and edematous

20.3 Drowning

Drowning is a form of mechanical asphyxia caused due to entry of water, or any other fluids into the air passage after submersion in water, or in any other fluids. Complete submersion is not needed.

Types of Drowning

1. Typical drowning (wet)

- Fresh water drowning
- Sea water drowning

2. Atypical drowning

- Dry drowning
- Immersion syndrome (Hydrocution)
- Secondary drowning (post immersion syndrome)
- Shallow water drowning
- Near drowning

Typical (wet drowning)

It is a type of drowning in which the water is inhaled into the lungs. In autopsy, the lungs are found filled with water. It is called **wet drowning**.

❖ Fresh water drowning

- This is the most common type of drowning. Normally the term drowning refers to wet drowning.

❖ Sea water drowning

Process of Drowning

- ❖ When a person falls into water, he first sinks due to the force of fall, and specific gravity of the body. He rises to the surface of water due to the buoyancy of the body and swinging action.
- ❖ The person cries for help and struggles and inhales air and water. Some of the air in the lungs will be replaced by water and he sinks down due to the increase in weight.
- ❖ He again rises up, inhales water and air and sinks down. This is repeated for many times depending on vitality of the person and finally he sinks in the water.
- ❖ In the final stage, there will be convulsions, a period of suspended animation, coma and death.

Fresh water Drowning

- ❖ It is the drowning in fresh water, (i.e. ponds, lakes, canals, river); so it is known as fresh water drowning.

- ❖ In this, fresh water is inhaled into the lungs and it reaches alveoli. Here the pulmonary alveolar lining acts as a semi-permeable membrane between alveolar water and blood. Since the alveolar water is relatively hypotonic compared to blood, alveolar water is rapidly absorbed through alveolar membrane into the blood plasma. It leads to hypervolemia and haemodilution.
- ❖ Hypervolemia overloads the heart leading to ventricular fibrillation and heart failure.
- ❖ Hemodilution also leads to hyponatremia, which leads to ventricular fibrillation causing heart failure and death.
- ❖ Fatal period – 4 minutes

Sea water Drowning

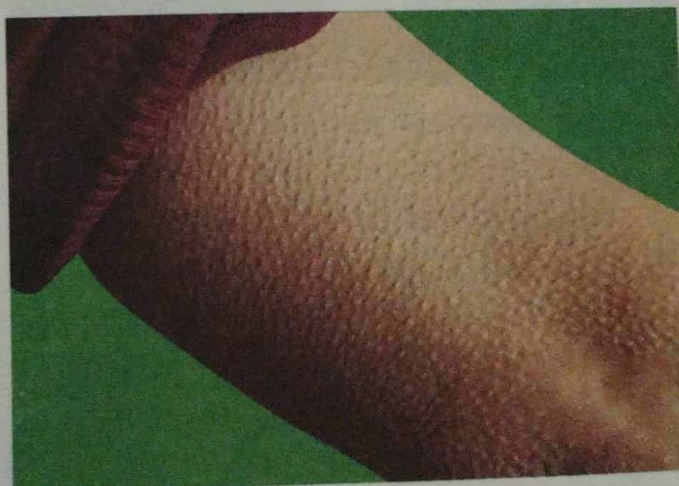
- ❖ Drowning in sea water is known as sea water drowning. Sea water contains very high concentration of salt and relatively hypertonic as compared with blood.
- ❖ It is just opposite of that in fresh water drowning.
- ❖ While drowning, the sea water enters the lungs and reaches the alveoli. Here the pulmonary alveolar lining acts as a semipermeable membrane between alveolar water and blood. Since this alveolar water is relatively hypertonic in comparison with blood, the water is drawn from the circulation into alveoli by osmosis. It leads to hypovolemia and haemo-concentration.
- ❖ The water comes out of RBC causing it crenated.
- ❖ Simultaneously, the sea water from lungs also enters the circulation, which causes Na ions increase in the plasma causing hypernatremia which leads to bradycardia then to heart failure and death.
- ❖ Severe pulmonary edema
- ❖ Fatal period: 8-12 minutes in sea water

Autopsy findings

1. Cloth and body will be wet and clammy
2. Face cyanosed, conjunctiva congested, pupils dilated, tongue swollen and protruded, froth at nostrils and mouth
3. **Froth:** Fine, white, leathery, tenacious, mushroom like mass at nostrils or mouth. On wiping, the froth reappears especially on chest compression. Froth formed by the churning action of heavily secreted tenacious mucus from trachea and bronchial mucus gland with air and water causes violent respiratory effort.



4. **Cutis anserina (goose skin) (puckered appearance):** This occurs due to spasm of the erector pilae muscles and contact with cold water. It cannot be taken as a confirmatory sign of ante-mortem drowning. It can be seen in rigor mortis also.



5. **Washerwoman's hands and feet:** The skin appears just like the skin of washerwoman that is bleached, soddened, thickened and wrinkled. It is merely a sign of submersion in water and not a sign of ante mortem drowning.



6. **Cadaveric spasm:** A grass, gravel, sand mud or weeds or any aquatic plants may held firmly in clenched hands due to cadaveric spasm. It is a vital proof of antemortem drowning.



7. **Rigor mortis or putrefaction:** According to Casper's dictum, rate of putrefactive changes in water is twice as slow as in air.
8. **Hypostasis:** In standing water, hypostasis may be present at head, neck, front of chest, hands and feet, but in running water, it does not develop due to constant movement.

Internal findings

1. **Trachea and bronchi:** Full of froths and water
2. **Lungs:** Congested and pale
 - **Paltauf's haemorrhage:** Large patches of sub-pleural haemorrhages (seen in 50% cases). It is a multiple, shining, pale pink or bluish red, up to 3-5cm in diameter. Paltauf's spots, which are larger than Tardieu's spots, are not sharply defined due to haemolysis.



Fig: Tardieu's spots

- **Emphysema aquosum and oedema aquosum:** These are very important findings in lungs in wet drowning.

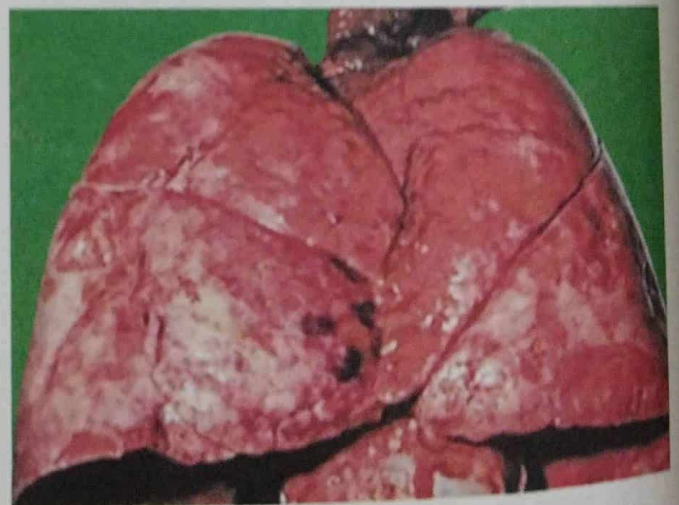


Fig: Emphysema aquosum

- (See the table next page)
3. **Right side of heart is dilated:** After inhalation of water, pulmonary

Features	Emphysema aquosum	oedema aquosum
Seen in victim	Live and conscious	Live and unconscious
Violent respiratory efforts	Present	Absent
Entry of water	The water enters the lungs actively at each respiratory effort	The water enters passively into the lungs
Churning of water and mucus	Yes	No
Froth in air passages	Yes in excess	No or very less
Amount of water in lungs	Relatively less (constant coughing and spasm of air passages)	In excess (absent cough reflex, water enters with each inspiration)
Lungs at autopsy	Voluminous, bulky, water logged and over inflated filling the chest cavity On cut: emphysematous, watery, frothy, blood-stained fluid oozes out	Simply over distended with water
Alveolar wall	Ruptured due to violent effort	Intact

circulation stops and back pressure is exerted into the right side of the heart.

4. **Stomach:** Due to over stretching, micro-ruptures of gastric mucosa- sehret's sign

• **Wydler's sign:** This test indicates water's only to the stomach

5. **Spleen:** Size and weight decrease as a victim of drowning tends to hold breath which causes spleen to contract.

6. **Water**

• Water in stomach: Present in 75% cases. Water enters into the intestine due to peristaltic movement, if the water contained in the stomach and water from the drowning medium then it suggest ante mortem drowning

• Water in middle ear: Middle ear contains water due to violent efforts at inhalation. Water enters through Eustachian tube.

• Water in paranasal sinuses, especially in maxillary and sphenoid sinuses

7. **Blood in middle ear (Ueno's sign):** Gross haemorrhage in petrous and mastoid region of temporal bone in drowning.

8. Brain congested and edematous

9. Blood is fluid

10. All organs are congested

Atypical Drowning

1. Dry drowning
2. Secondary drowning (post immersion syndrome)
3. Immersion syndrome (Hydrocution)
4. Shallow water drowning
5. Near drowning

1. Dry Drowning

❖ In this form of drowning, water does not enter into the lungs, but water enters the nasopharynx, or larynx and there will be immediate sustained laryngeal spasm, the person dies due to asphyxia.

❖ No classical signs of asphyxia

❖ Fall in water-water enters into naso pharynx and larynx-laryngeal spasm-asphyxia-death

2. Secondary Drowning (Near Drowning) (Post Immersion Syndrome)

❖ If the victim survives more than 24 hours, he may develop secondary complication of drowning. This is called secondary drowning.

There are near drowning cases in which the person develops the following complications:

- The person may or may not be conscious
- He may develop pulmonary oedema, and ARDS, pneumonia and septicemia
- There may be hypoxic brain damage
- There may be hemoglobinuria due to lysis of RBC's
- There may be myocardial anoxia and cardiac arrhythmia

3. Immersion Syndrome (Hydrocution)

- ❖ When a person enters cold water, vasovagal inhibition and cardiac arrest occur due to stimulation of cutaneous nerves of the chest and abdomen. It is called hydrocution.
- ❖ In autopsy, classical signs of asphyxia are not usually seen.

4. Shallow Water Drowning

- ❖ Under the influence of alcohol or drugs, an unconscious person may drown in shallow water.
- ❖ When they fall into water the struggling movements are absent and as a result classical signs of asphyxia are absent.
- ❖ Simply flooding of lungs in water occurs and is known as edema aquosum

5. Near Drowning

- ❖ **Near drowning** refers to a situation where an individual experiences suffocation due to submersion in water but survives, either temporarily or permanently.
- ❖ This critical event often leads to hypoxemia (low oxygen levels in the blood), which can result in significant injury to vital organs, particularly the brain.
- ❖ Immediate and effective medical intervention is crucial to improve the chances of recovery and prevent long-

term complications such as neurological damage or respiratory issues.

- ❖ Near drowning is considered a medical emergency and often requires intensive care to manage the potential consequences.

Hydrostatic lungs

If a dead body remains in water for 20 hrs at a depth of 2m, the water enters the lungs passively. In autopsy, water is seen in lungs without froth.

Laboratory Test In Drowning

There is no single test to confirm drowning.

Gettler's Test (Chloride Estimation)

- ❖ Blood is extracted from the ventricles of heart
- ❖ Tested for chloride
- ❖ Normal value of chloride is 600mg/100ml
- ❖ In salt water, the chloride concentration increases 42% than normal value due to hemoconcentration
- ❖ In fresh water drowning, the chloride ion concentration is 50% less than the normal value due to hemodilution

Diatom's Test

- ❖ Diatoms are unicellular organisms present in fresh water and salt water. They are water specific. Their siliceous shell is heat and acid resistant.
- ❖ Diatoms may enter the lungs while drowning and pass to the blood stream and may enter all the internal organs. They can be well demonstrated in internal organs and bone marrow.

Procedure

1. **Extraction of diatoms Acid digestion:**
Take 5gm of bone marrow or 100gm of soft tissues in a flask--- add 25ml of concentrated HNO_3 into it--- keep the sample undisturbed for 2-3 days---all

organic tissues are digested but not diatoms---the tube contains now the supernatant solution above and solid residue below---the supernatant fluid discarded--- **centrifugation**: The solid residue is centrifuges---then again supernatant solution is discarded again---repeat centrifugation for 3 more times---the solid residue is examined under microscopic examination--- if it matches those recovered from the reference sample of water--- then antemortem drowning is established.

Differences Between Antemortem and Postmortem Drowning

Features	Antemortem drowning	Postmortem drowning
Signs of asphyxia	Present	Absent
Froth at mouth and nose	Present	Absent
Cadaveric spasm	Present	Absent

Features	Antemortem drowning	Postmortem drowning
Water in lungs	Present	Absent
Getterler's test	+ve	-ve
Diatoms's test	+ve	-ve
Hands tied behind the neck	May be	No

Medicolegal Aspects of Drowning

- ❖ Antemortem drowning and postmortem drowning: Some antemortem features of drowning are: froth at mouth and nostrils, water in stomach, cadaveric spasm (weeds or grass or gravels clenched in the fist, sand particles in the airway, haemorrhages in the middle ear, diatoms in distant organs.
- ❖ Accidental drowning: It is very commonly seen in India.
- ❖ Suicidal drowning: Rarely occurs
- ❖ Homicidal drowning: Also occurs

Summary

Asphyxia

It is a state in living organisms in which there is acute lack of oxygen available for cell metabolism associated with inability of body to eliminate excess of carbon dioxide

Signs of asphyxia

- ❖ Petechial hemorrhage
- ❖ Visceral congestion & oedema
- ❖ Cyanosis
- ❖ Postmortem fluidity of blood
- ❖ Cardiac dilatation

Hanging

It is a type of mechanical asphyxia where a body is suspended by a ligature around the neck, the force of constriction being the weight of the body

Types

1. **Typical**: knot at the nape of the neck
2. **Atypical**: knot anywhere except the nape of neck

Based on the position of Body

1. **Complete**: whole body is suspended
2. **Partial**: part of the body touches the ground

Cause of death in Hanging

1. Occlusion of airway – (trachea) 15 kg is sufficient
2. Occlusion of jugular vein (3.5-5kg) is sufficient
3. Occlusion of carotid arteries (5 Kg is sufficient)
4. Vaso vagal inhibition

5. Occlusion of vertebral arteries- 16 kg
6. Injury to spinal cord: long drop

External autopsy findings

- ❖ Ligature mark on the neck
- ❖ Stretching and elongation of neck
- ❖ Salivary dribble marks
- ❖ Swollen face with protrusion of tongue and eye balls
- ❖ Bluish discolouration on lips, tip of tongue and nails
- ❖ Sub conjunctival hemorrhages
- ❖ Bleeding from nose and ears
- ❖ Dilated pupil
- ❖ Glove and stocking type of lividity

Stangulation

It is a form of mechanical asphyxia, which is caused by constriction of neck by a ligature, without suspending the body. So in strangulation the constricting force is anything other than the weight of the body.

Classification

1. Ligature strangulation
2. Manual strangulation
3. Palmar strangulation
4. Mugging
5. Bandsdola
6. Garroting

Suffocation

Suffocation is a type of mechanical asphyxia caused by obstruction of the passage of air into the lungs. (Excluding constriction of the neck and drowning)

It includes

1. Smothering
2. Gagging

3. Choking
4. Traumatic asphyxia
5. Wedging- It means compression of the body, within narrow space. The chest wall movements, are prevented, which leads to asphyxia.
6. Positional asphyxia (postural asphyxia)
7. Overlaying
8. Burking

Drowning

Drowning is a form of mechanical asphyxia produced by entry of water, or any other fluids or any other fluids into the air passages caused by submersion in water, or in any other fluid. Complete submersion is not needed.

Types of Drowning

1. Typical drowning(wet)
 - Fresh water drowning
 - Sea water drowning
2. Atypical drowning
 - Dry drowning
 - Immersion syndrome (Hydrocution)
 - Secondary drowning (post immersion syndrome)
 - Shallow water drowning
 - Near drowning

Diatoms Test

This test is based on the principle that diatoms can be detected in the organs of drowned victims if they aspirated diatom rich water into the lung before death. They are unicellular photosynthetic and autotrophic organisms that live both in fresh water and salt water.

Important Questions MCQ

1. **La facie sympathique** is the postmortem feature in
 - a. Drowning
 - b. Injuy
 - c. Smothering
 - d. Hanging
2. **Clasical signs of asphyxia except**
 - a. Odema & congestion of organs
 - b. Petechial haemorrhages
 - c. Hyoid bone fracture
 - d. Cyanosis
3. **Typical hanging is**
 - a. Complete suspension of the body
 - b. Partial suspension
 - c. Knot is placed on right side of the neck
 - d. Knot is placed in the occipital region
4. **Air way occlusion happens in the pharyngeal level refers to**
 - a. Smothering
 - b. Traumatic asphyxia
 - c. Burking
 - d. Gagging
5. **Plastic bag suffocation is**
 - a. Smothering
 - b. Gagging
 - c. Choking
 - d. Overlaying
6. **Cause of death in café coronary**
 - a. Asphyxia
 - b. Reflex vagal inhibition
 - c. Ventricular fibrillation
 - d. Choking
7. **Victim is strangled at crook of elbow refes to**
 - a. Garroting
 - b. Bandsola
 - c. Mugging
 - d. Burking
8. **Lynching is a type of asphyxia in which**
 - a. Strangulation
 - b. Homicidal hanging by mob
 - c. Suffocation
 - d. Typical drowning
9. **Hyoid bone fracture does not occur in**
 - a. Smothering
 - b. Throttling
 - c. Strangulation
 - d. Hanging
10. **Not a sign of antemortem drowning**
 - a. Cadaveric spasm
 - b. Persistent froth at nose and mouth
 - c. Washer woman's hand and feet
 - d. Water in stomach

Answer key

1. d	2. c	3. d	4. d	5. a
6. b	7. c	8. b	9. a	10. c

Learning Objectives

- Define hanging, describe the classification, causes of death, postmortem appearance and medicolegal aspects.
- Define strangulation and suffocation, enlist the postmortem appearance and medicolegal aspects.
- Define drowning, explain postmortem appearance and medicolegal aspects.

Important SAQ

- Define asphyxia.
- What are classical signs of asphyxia?
- Differentiate between hanging and strangulation.
- Differentiate between antemortem and postmortem drowning.
- What are different types of hanging?

Important LAQ

- Write about hanging and its autopsy findings.
- Define strangulation, write about various types of strangulation.
- Define drowning, its types, write about the autopsy findings of drowning.
- Define suffocation, its types and its medicolegal significance.
- Define choking. Write about café coronary and its management.

...

Injury

21.1 Basics of Injury

Definition

S. of IPC 44: Definition of Injury

- ❖ Injury is any harm whatever illegally caused to a body, mind, reputation and property.

In medical field, Injury means physical Injury

- ❖ **Trauma:** It is a physical or psychological injury.
- ❖ **Wound:** It is the breach of natural continuity of the skin or mucus membrane.
- ❖ **Weapon:** The article which is used for causing injury.

Classification of Injuries

I. Medical Classification of Injuries

In medical field injury means physical injury or injury to the body.

1. Mechanical injuries

- **Due to blunt force:** Abrasion, contusion, laceration, fractures, dislocations
- **Sharp force:** Incised wound, stab wound
- **Heavy sharp force:** Chop wound.
- Firearm injuries

2. Thermal injuries

- **Due to cold:** Frost bite, trench foot
- **Due to heat:** Burns and scalds

3. Firearm injuries

4. Chemical injuries: due to acids and alkalis

5. Injuries due to physical agents:

- Electrical injuries
- Lightning
- X-rays
- Radiation injuries

II. Legal Classification of Injury

1. Hurt (S. IPC 319)
2. Grievous injury (S. IPC 320)

III. Medicolegal Classification of Injury

1. Suicidal injuries (hesitation cuts)
2. Homicidal injuries
3. Accidental
4. Fabricated wounds: Self-inflicted and self-suffered wounds
5. Defence wounds
6. Iatrogenic injuries

Hurt

Hurt (Sec. 319 IPC): Whoever causes bodily pain, diseases or infirmity is said to cause hurt.

Grievous Hurt

Grievous hurt (S. IPC 320) includes the following

1. Emasculation
2. Permanent privation of sight of either eye

3. Permanent privation of hearing of either ear
4. Privation of any member of joint
5. Permanent impairment of power of any member or joint
6. Permanent disfiguration of head or face
7. Fracture or dislocation of bone or tooth
8. Any hurt, which endangers life, or which causes the victim to be in severe bodily pain, or unable to follow his ordinary pursuits for a period of 20 days

S. IPC 324: Punishment for voluntarily causing injury by dangerous weapon: 3 years imprisonment for fine.

S. IPC 325: Punishment for voluntarily causing grievous hurt: Up to 7 years imprisonments and fine.

S. IPC 326: Punishment for voluntarily causing grievous hurt by dangerous weapon: Imprisonment for a turn up to 10 years and also fine.

S. IPC 326A: Voluntarily causing grievous hurt by throwing acids: Whoever causes permanent or partial damage or deformity or disfigures or disables any part of the body throwing acid will be punished with 10 years of imprisonment.

S. IPC 326B: Attempt for throwing acid: Punished with imprisonment for 5 years, which may extend to 7 years and also fine.

Homicide

It means killing one human being by another human being.

Justifiable Homicide

1. Judicial execution
2. Suppressing riot to prevent harm
3. Killing for the private defence of the body, killing a person who tries to attack or rape a woman
4. Killing a person in private defence, of body and property, when there was no other means of defence

Excusable Homicide

1. Causing death by accident or misadventure
2. Death following the act of criminal intent
3. Death caused by child or a mentally ill person or an intoxicated person
4. Death caused in an act done in good faith which was done with consent or in emergency without consent

Culpable Homicide (Sec.299 IPC)

❖ **Culpable homicide:** Whoever causes death, by doing an act with the intention of causing death, or with the intention of causing such bodily injury, as is likely to cause death.

Murder (Sec.300 IPC)

❖ **Murder:** Murder is an aggregated form of culpable homicide. It is defined as killing a person, by another person or a group of people; who have the deliberate intent to the life of the former.

Basis of difference	Culpable homicide	Murder
Meaning	Someone who causes the death of another by doing an act likely to cause that person's death	Someone who does any act resulting death of another with the sufficient intention to cause that person's death
Degree of Intention	Less	More and must

21.2 Mechanical Injury

Mechanical injury means injury produced by mechanical force.

Classification of Mechanical injuries

1. By blunt force of weapon

- Abrasion
- Contusion
- Laceration
- Fractures

2. By sharp force of weapon

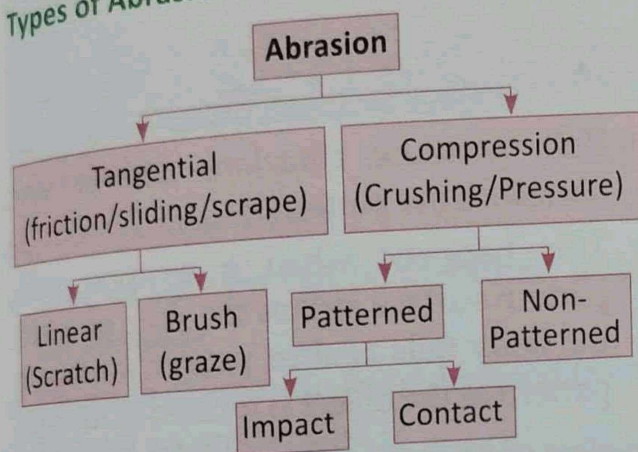
- Incised wound
- Stab wound

3. Firearm injuries

Abrasions

- ❖ An abrasion is a mechanical injury in which loss of superficial layers of the skin or mucus membrane occurs.
- ❖ Usually abrasions heal without scarring.

Types of Abrasions



A. Abrasions produced by **tangential** force

1. Scratch (linear abrasions)
2. Graze (sliding, gliding, glancing, scraping)

B. Abrasions produced by perpendicular source

1. Pressure (crushing abrasions)
2. Impact (imprint, contact)
3. Patterned abrasions

(a) Scratch (Linear abrasions)



Fig: Scratch

- ❖ It is produced by the horizontal or tangential movement of the tip of a pointed object, like thorns, nails, tip of pointed knife, pin etc.
- ❖ In this type, it is having an appreciable length and width is minimal, there may be heaping of tissues at one end (epithelial tags), this indicated the direction of movement of weapon

(b) Graze (sliding, gliding, glancing, scrape, brush)



Fig: Graze

- ❖ It is the superficial injury on the skin, caused by tangential sliding movement of **broad or wider rough surface against skin**.
- ❖ They are most common type of the abrasion. It consists of multiple uneven linear and parallel injuries over a significant area, so it has significant length and breadth.
- ❖ The graze abrasion may also extend partially into dermis involving and causing bleeding.
- ❖ The direction of graze abrasion can be found by observing heaped up epidermis (epithelial tags).
- ❖ **Friction burn/brush burn/gravel rash:** A graze abrasion frequently occurs by **dragging at rough** road side in road traffic accidents, some foreign body

for example: **Dirt, grit and gravel may stick** to the abrasion which indicate the surface at which dragging happened, sometimes during dragging the great friction generates heat, due to this the graze abrasion appears partially burnt. This type of graze abrasion is known as friction burn.

(c) Pressure Abrasion (crushing abrasions)



Fig: Pressure abrasion

- ❖ When relatively small force is applied, perpendicularly to the skin, continuously for a long period of time it results into **crushing of epithelium**.
- ❖ It means sustained pressure results in pressure abrasion.
- ❖ Examples are ligature marks in hanging and strangulation, teeth bite marks and nappy rashes.

(d) Impact Abrasion (contact abrasion)

- ❖ When a large force is applied perpendicularly to the skin suddenly for a very short period of time it results into crushing of epithelium.
- ❖ Sudden and momentary pressure results in impact abrasions.
- ❖ This type of impact abrasions are depressed than the surface but may be elevated due to the development of underlying contusion.

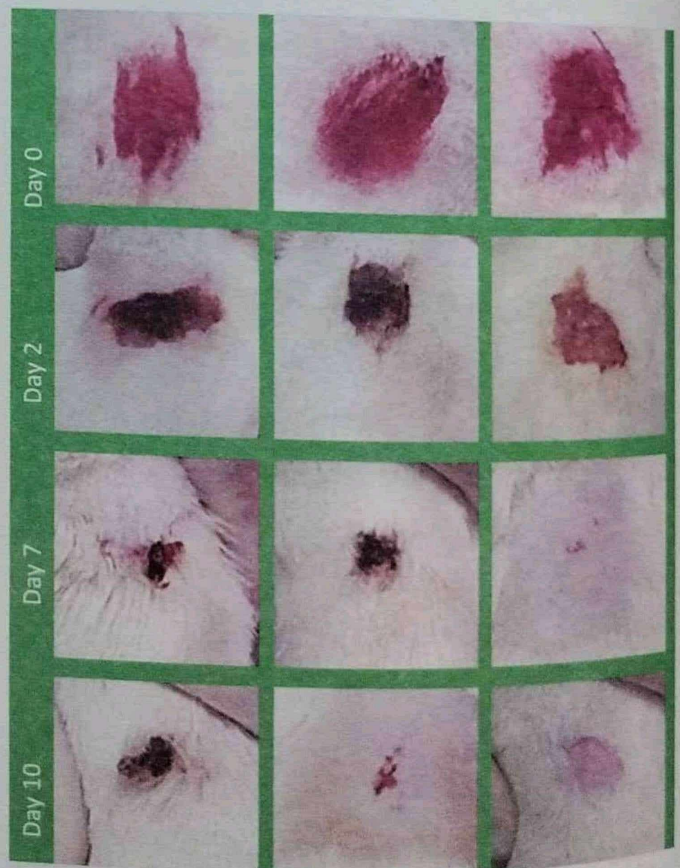
- ❖ Examples are radiator grill marks, tyre marks and shoe marks in kicking.

(e) Patterned Abrasions



- ❖ Both pressure abrasions and imprint abrasions are patterned.
- ❖ This happens when a weapon with pattern surface strikes the skin, or when the body falls against pattern surface, a pattern of the object is formed in the skin.

Healing of Abrasions

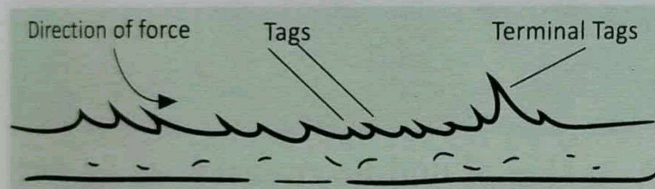


- ❖ Since pure abrasions involve only epidermis, it never bleeds. Thus, it heals without scar formation.

- ❖ When abrasion involves dermal papillae, it bleeds and results in scar formation.
- ❖ Healing involves 2 processes, **contraction of wound** and **replacement of lost tissues**.
- ❖ Fresh abrasion is red in colour.
- ❖ Scab forms in **12-24 hours**.
- ❖ Its colour varies from red to reddish brown and dries in **2-8 days**.
- ❖ Abrasion heals from periphery to centre by new growth of epithelial cells.
- ❖ Ordinary scab dries and falls off in **7-8 days**.

Medicolegal Significance

- ❖ Type of weapon can be identified from the abrasion.
- ❖ Direction of force can be understood from **heaped up epidermis**.



- ❖ **Time of assault:** It can be understood by colour change of the abrasion.
- ❖ Abrasion is usually considered as simple injury (IPC 319) because it involves superficial epidermis. If it involves dermal papillae and causes bleeding and disfigurement in face or head, it is considered as grievous injury (IPC 320).
- ❖ **Fabricated abrasions:** A person can inflict abrasion or injury on himself for labelling false charges against enemies.
- ❖ **Postmortem abrasions:** These can be caused by manual handling of body after death or ant bite or erosions.
- ❖ **Nature of offence:** In sexual offences, the abrasions are found at or around breast and inner side of the thighs.

Features	Antemortem abrasion	Postmortem abrasions
Site	Anywhere	Usually on the bony prominence due to dragging of a dead body
Colour	Bright red	Yellowish, pale, parchment like
Exudation	More scab formation	No exudation no scab
Vital reaction	Present	Absent
Healing process	Evident	Not seen

Bruise or Contusions



- ❖ Contusions or bruises are produced by extravasation of blood into the soft tissues due to rupture of blood vessels caused by blunt trauma.
- ❖ Contusion present not only externally as well as internal organs like heart, lungs or brain etc.
- ❖ Externally, it may be visible as colour changes or as a slight swelling with or without abrasions over it.

Classification of Bruises

- 1. Intradermal:** Intradermal bruises usually produced by sudden violent impact of the blunt surface of light weapon, e.g. metallic scale.

2. **Subcutaneous:** These are bruises produced on fatty layer and deeper than intradermal layer.
3. **Deep:** This types of bruises occur in superficial muscles and muscular planes.

Factors Affecting Bruising

1. **Age:** Bruises are easily produced in children and old people.
2. **Sex:** Bruises are more produced in woman because of more delicate tissue and more fatty tissue.
3. **Size of body:** Bruises occur more in obese people than in lean people.
4. **Colour of skin:** Bruises are easily visible in fair skinned people.
5. **Size and type of tissue involved:** Soft, lax and vascular tissues (e.g. scrotum, face, eyelids) develop large bruises even in case of minimal blunt trauma.
6. **Natural diseases:** Bruises develop easily in persons suffering with cirrhosis, haemophilia, scurvy, vit K deficiency, etc.

Ectopic Bruise or Migratory Bruise or Perculated Bruise

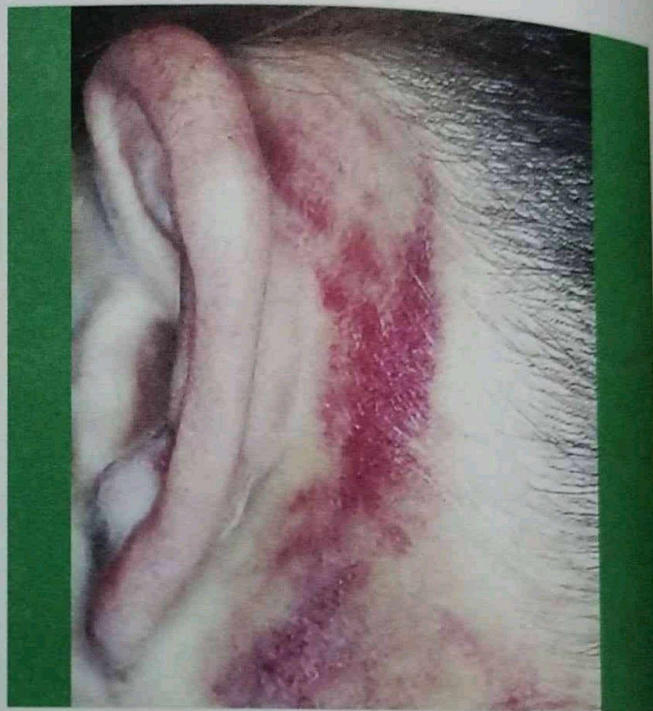
The bruises appear at the site other than the site of impact. This is due to extravasation of blood from the site of injury to areas of least resistance. e.g.

Black Eye (Raccoon's eye/Panda eye)



- ❖ In case of anterior cranial fossa fracture, extravasation of blood around the eye and in the periorbital tissue is observed. It is due to percolation of blood to periorbital tissues. This is known as black eye. It is not bruise but an effect of bruise.

Battles Sign (Mastoid echymosis)



- ❖ In case of middle cranial fossa fracture, there may be percolation of blood to the lateral aspect of head, behind the ear, called as Battle's sign.

Contusion may change its position due to gravity

- ❖ **Fracture of jaw:** Bruise on neck
- ❖ **Fracture of pelvis:** Bruise appears in thigh
- ❖ **Fracture of femur:** Bruise on lower outer aspect of thigh
- ❖ **Blunt injury to calf:** Bruise appears around calf

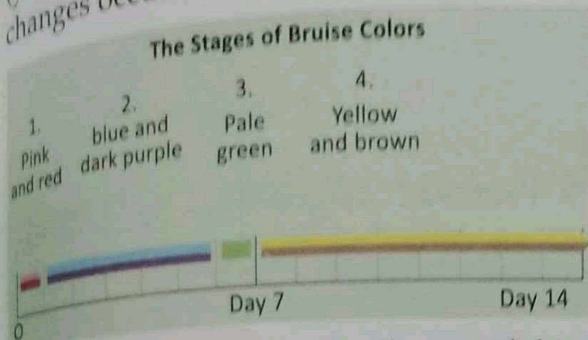
Age of Bruises

The age of the bruise can be estimated by colour change as well as histological changes.

Colour changes of Bruise

In a living person, the extravasated blood undergo colour changes. RBC breaks down

and liberates Hb which is broken down by enzymes into haemosiderin (brownish), haemotoidin (green) and then bilirubin (yellowish). Due to these pigments, colour changes occurs in issues:



- ❖ **Fresh:** Reddish due to oxy haemoglobin
- ❖ **1-3 days:** Bluish black or purple (reduced Hb)
- ❖ **4 days:** Brownish (due to haemosiderin)
- ❖ **5-6 days:** Greenish (haemotoidin)
- ❖ **7-10 days:** Yellow (due to bilirubin)
- ❖ **2 weeks:** Normal skin colour

Medicolegal Aspects of Bruises

1. Age of bruise: The time since infliction of injury can be understood by colour changes. It can be correlated with the date and time since the bruise happened.

- 2. Some special bruises:** (1) Butterfly bruise: pinching (2) Bead string bruises (3) Six penny bruises: Multiple small bruises formed by pressure of finger tips (4) Doughnut bruise: Ring of bruise with a paler centre by cricket ball.
- 3. In battered baby syndrome:** Changes in the bruises of different colour may occur at a particular time.
- 4. A bruise should be differentiated from Mongolian spot,** which are bluish black marks on the lumbosacral area seen at the time of birth due to melanocytes accumulation.
- 5. A medical examiner should recheck the patient after a period of 24 hours,** by this time the bruises are clearly visible.
- 6. Bruises are to be differentiated from hypostasis.**

See the table Down

7. Artificial Bruise

- These are fake bruises produced by rubbing some irritant substance, like juices of Calotropis, Semecarpus anacardium, Plumbago rosea on the

Features	Postmortem lividity	Bruise
Cause	Distention of vessel with blood	Rupture of vessels
Site	Most dependent part	Anywhere
Appearance	Not elevated	Elevated. Swollen
Margins	Clearly defined	Not clearly defined
Colour	Uniform bluish purple	Different colours depending on the age of the bruise
Abrasion	Not present	May be present
On incision	Blood is seen in blood vessels which can be easily washed away	Blood is seen outside the vessels, that cannot be washed away
Shifting	On changing the position of body	No change
Effect of pressure	Colour of hypo-stasis blanches on application of pressure and reappears on its release	No change
MLI	It suggests about the position of the body at death and time since death	It suggests about nature of weapon used and also the nature of injury



11. Postmortem Bruises

- The bruises which appear after death, are called postmortem bruises.
- These may be caused by postmortem injury and even ante-mortem injury. Suppose death has occurred soon after blunt trauma, the bruise appears after death.

Features	Ante-mortem bruises	Postmortem bruise
Swelling	Present	Absent
Damage to epithelium	Present	Absent
Coagulation	Present	Absent
Extravasation of blood	Present	Absent
Colour changes	Present	Absent
Margins	Merges with surrounding area	Sharply demarcated

Lacerations

Laceration=**to tear**



- ❖ It is the form of mechanical injury, characterised by tear of skin, mucus membrane, muscle or internal organs caused by blunt force.
- ❖ The lacerations are three dimensional injuries caused by blunt weapon, (hammer, iron rod, etc.)
- ❖ A blunt force may be either shearing force or crushing force. During the blunt trauma, the tissues get stretched or crushed beyond the limits of their elasticity to produce laceration.
- ❖ Laceration injuries are having irregular and uneven margins.

- ❖ It can be called as abraded laceration and contused laceration as the laceration contains abrasion or contusion along their margins.

Bridging of Fibers or Tissue Bridges

They are the hall marks of lacerated wounds and indicate that the wounds are not clearly cut.

- ❖ They are found in the depth/base of lacerated wound.
- ❖ **Appearance:** They can be seen when edges of the wound are gently separated manually.

This means the vessels and tissues are not completely torn but are still connected, by a bridge of tissue of blood vessels, nerves, or elastic fibers from one side of the laceration to the other.

- ❖ **Bridging** may also be found in the laceration of internal organs. e.g. liver kidney and spleen.
- ❖ It is not seen in incised wound as it is clearly cut.

MLI

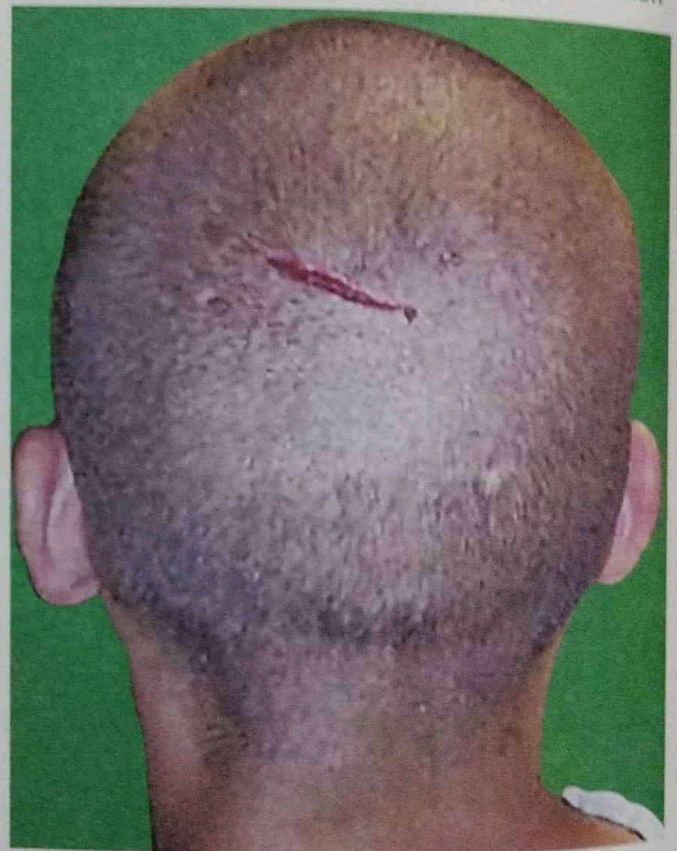
- Presence of bridging fibres in a bleeding wound indicates that blunt weapon is used to cause such injury.
- Associated abrasion or bruise around the lacerated wound confirms blunt weapon.
- The bleeding injury showing bridging fibres is laceration.
- The hair bulbs in the skin around laceration may be crushed but not cut as in incised wound.
- Hair, debris, foreign materials, grease, mud and epidermal tags are present in the wound. A hand lens can be used to find out these cases.
- **Haemorrhages:** It is less seen in laceration as compared to incision wound

because in lacerations the blood vessels are crushed or torn irregularly.

- **One exception of haemorrhage:** On scalp laceration the bleeding is more as copious flow of blood to scalp occurs.
- Lacerated wound may show bevelling if the striking force is tangential, especially on the head.

Types of Laceration

1. Split laceration: Incised looking laceration



- ❖ Splitting occurs by crushing of skin and soft tissues in between 2 hard objects.
- ❖ It happens when blunt force is applied to an area of the body where skin directly overlies a bone with minimal amount of overlaying subcutaneous tissues. It may causes the linear splitting of tissues.
- ❖ Usually it occurs on the bony prominences like head, knee, elbow, eyebrow, and zygomatic process.
- ❖ At the areas the linear splitting of tissues may appear clean cut, which may look

like an incised wound but actually it is a lacerated wound. So it is considered sometimes as incised looking lacerations. But the margins are irregular and bruised. Tissue bridging is seen at the base. On microscopic examination, hair bulbs in the skin around the incised looking laceration may be seen crushed but not cut as seen in incised wound.

2. Stretch Laceration



- ❖ The laceration occurs from overstretching of the skin and soft tissues due to a heavy forceful impact exercising a localized pressure. Stretching of tissues can occur in run over by motor vehicle.
- ❖ A blunt force when applied on the body overstretches the skin and sub cutaneous tissue resulting in stretch laceration.
- ❖ A large flap of skin is formed, which is still attached with the skin at one end, and it can be replaced back on the wound to cover it up.

Example: Glancing kick by boots

3. Avulsion laceration

- ❖ It is commonly seen in run over cases by vehicles in RTA. (Road Traffic Accidents)

- ❖ This occur due to a shearing force occurred at an oblique angle to detach the skin and sub cutaneous tissue over a larger area.
- ❖ A large area of skin and sub cutaneous tissues separate from underlying tissues and are lost resulting in large extensive open injuries, that is the wound devoid of any overlaying skin. This is also known as flaying.
- ❖ Underlying muscles are heavily bruised and crushed.
- ❖ Amputation injuries of the limbs are a type of avulsion injury.



Medicolegal Importance of Lacerations

1. Lacerations are usually accidental or homicidal, rarely suicidal.
2. Patterned laceration: The type of laceration may suggest the shape of the blunt weapon.
3. The foreign substances in the wound can give a clue about the weapon. Example: paint on the vehicle may be transferred into the lacerations.
4. Extensive laceration with amputation: Grievous hurt.

Incised Wound



Incised wound: It is a clean cut wound caused by sharp edged weapon. For example: Blade, razor, knife, scalpel and broken glass.

Incised wound is longer than its depth due to swipe action

Dimensions

1. **Shape:** Spindle shape cut happens due to great retraction of edges in the centre. Gaping is maximum if underlying elastic fibres or the muscle fibers are cut transversely (Langer's line), and minimum if elastic fibers and muscle fibres cut longitudinally.
2. **Margin/edges:** Clean cut, well defined and everted. at certain sites where the skin is wrinkled (e.g. gets scrotum) the margins that may be irregular or inverted. The incised wound produced in the wrinkled surface may appear as lacerated due to irregularity of the edges of wound. These are known as lacerated looking incised wound.
3. **Angles:** The ends of incised wound are called angles.
4. **Length:** The distance between 2 opposite angles is the length. The length of

incised wound is greater than the width and depth.

5. **Width:** The widest measurement between 2 margins is its width. The width of incised wound is greater than the width of the weapon.
6. **Depth:** Depth is more at the beginning of incised wound.

Features

- ❖ No abrasions or contusions and no tissue bridging is seen at the base of incised wound.
- ❖ Tailing of the wound: More pressure is applied on the weapon at the beginning, so the incised wound is deeper at the beginning. This deeper end of the wound is known as head of the wound. After a distance or while reaching at the end of the wound, the wound becomes more shallow towards the tail as the knife is gradually withdrawn. Finally, knife leaves the tissue by leaving a scar or line. It is known as tailing of the wound.
- ❖ Beveling cut: If the blade of the weapon enters the body tissues obliquely (striking angle of weapon is not perpendicular), it creates a beveling cut. The slanting roof is very thin and a wound with flap is produced. The beveled surface shows abrasions.
- ❖ A beveled wound is usually homicidal in nature and may indicate relative position of assailant and a victim.

Cut Throat Wounds

- ❖ **Cut throat wounds:** These are the injuries (incised wounds) in which throat is cut by sharp edged weapon. The thyroid cartilage/larynx and major blood vessels on the neck along with other soft and hard tissues are cut.

- ❖ **Clinical features of cut throat injury:** Hoarseness, laryngeal stridor and dyspnea due to aspiration of blood, external blood loss and varying degree of shock.



❖ Causes of Death

1. Haemorrhagic shock.
2. Choking due to blood may occur if larynx or trachea is cut.
3. Air embolism in cut throat injuries air is sucked into the veins due to the negative pressure created in the vein. In arteries, the air usually does not enter due to positive pressure.

Chop Wound or Slash Wound

- ❖ Chop wounds are a type of incised wound and are also known as cut slash wounds.
- ❖ Chop wounds are produced by heavy cutting weapons like chopper or sword.
- ❖ The margins will be infiltrated with blood.
- ❖ The depth of the wound is almost equal as the whole blade touches the body simultaneously.
- ❖ In chop wound, the bone underneath is usually cut,
- ❖ Chop wound on the skull cuts the bone underneath and enters the skull cavity, producing a clean cut on the bone and

may produce fissured fractures on either end. This may be due to twisting of weapon during withdrawal.

- ❖ Chop wounds are usually homicidal in nature, usually inflicted on the exposed portions like head, face, neck, shoulders and extremities.
- ❖ Suicidal chop wounds are very rare.

Bevelled cut



- ❖ In a tangential cut with the weapon, there may be bevelling of margins. In an oblique cut on the head, a piece of bone may be chipped off.
- ❖ A beveling cut indicates that the weapon is a heavy cutting one.
- ❖ Beveled cuts are usually homicidal in nature.
- ❖ If the extremities are attacked there may be complete or incomplete amputation of fingers or limbs.

MLI

1. Most of the injuries are homicidal.
2. Examination of wound may give clue about the causative weapon.
3. It may be accidental rarely suicidal.

Healing of incised Wound

1. **Healing by primary intention:** The healing occurring in uninfected wound is known as healing by primary intention. Here

inflammatory reaction is less intense. Such wound heals with minimal scarring and is having very less inflammatory reaction.

2. **Healing by secondary intention:** The healing occurring in infected wound is known as healing by secondary intention. Here inflammatory reaction is more severe. There is more formation of granular tissue. This wound heals with more granular tissues.

Medicolegal Importance of Incised Wound

1. An incised wound helps to determine the nature of weapon (sharp single or double edged, light or heavy).
2. It gives a clue about direction of force applied.
3. It helps in determining the relative position of assailant and victim.
4. Age of the injury can be determined.
5. Fatality is rare because penetration to the large blood vessels is comparatively less
6. Manner of injury

Suicidal hesitation marks or tentative cuts



Hesitation cuts, tentative cuts, trial wounds: It is characterised by multiple, parallel and superficial cuts on either side of the main injury. These are called the hesitation cuts (tentative cuts, trial wounds). These are due to hesitation or withdrawal of the weapon because of pain, till he gets the courage for a final fatal cut

MLI of hesitation marks

- ❖ These are produced at the initial part of a deep incised, self-inflicted wound.
- ❖ These are usually caused by a light sharp cutting weapons like knife or razor blade.
- ❖ It indicates the hesitant state of mind of suicide.
- ❖ It indicates the direction of cut.

Usual sites of hesitation cuts

- ❖ Front of neck
- ❖ Front of wrist and forearm
- ❖ Front of elbow

Homicidal Incised Wound

The wounds are usually multiple, fatal and may be seen on areas inaccessible to victim himself.

Incised wounds in face and genitals suggestive of homicidal. Defence wounds are also seen in cases of homicidal.

Defence Wounds

- ❖ The wound sustained by a person either in an attempt to grasp the weapon of offence (active defence wound), or an attempt to protect himself from the blows by raising arms (passive defence wound) are called as defence wounds.

- ❖ **MLI:** Presence of defence wound indicates homicide and person was conscious at the time of assault.

- ❖ **Absence of defence wound indicates** Suicide or accident or the victim was unconscious or he was under alcohol or drugs.

- ❖ **Offensive injuries** are sustained when the person hits other. These may be abrasions, bruises, and lacerations.

Accidental: Commonly seen at the hands, it can occur at home. (During cutting fruits and vegetables).

Fabricated wound (fictitious wounds/forged wounds): The injuries inflicted by a person in

his own body are called fabricated wounds. (Self-inflicted wound), or occasionally produced in another person's body with his consent is called fabricated wound.

Characteristics: These may be abrasions, bruises, incised wounds, or punctures.

❖ Fabricated wounds are mostly incisions. Usually multiple, superficial and parallel, they occur in easily accessible part of the body. For example: Front of forearm, outer side of upper arm, front of chest and abdomen and front of thigh.

Direction of fabricated Wound

1. At the top of head: from behind forwards with tailing in front
2. On outer side of upper arm: From above downwards.
3. At front of forearm: Below upwards, or horizontal.

MLI

- Fabricated wounds are produced to charge an enemy with assault or attempted murder
- To make simple injury a grievous one
- Prisoner's may bring a charge of beating against officers
- Woman may bring a charge of rape
- Recruits may create these wounds to escape military services
- Assistant may pretend self-defence
- Police man can create these wounds to show that they were defending the property during an attack
- The cuts on the dress do not correspond with the cuts on chest or abdomen in most of the time
- Incised looking lacerated wound: scalp, shin of leg
- Lacerated looking incised wound: site scrotum

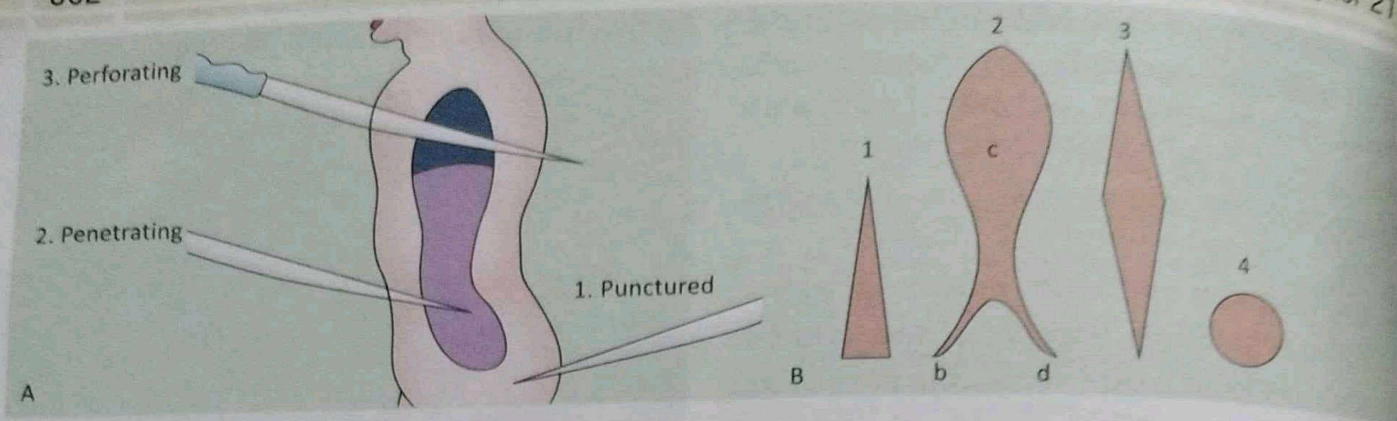
Punctured Wounds or Stab Wounds



- ❖ These wounds are produced by stabbing (perpendicular force) and the depth will be more than the length of the external wound
- ❖ Stabs are usually produced by knife, dagger, sword, screw driver, arrow and spear.
- ❖ Sharp (pointed end) weapons like knife, weapon, sword etc. produce incised puncture wounds with clean external wound.
- ❖ Blunt weapons like cricket stumps, iron rod, screw driver and iron rods produce lacerated puncture wounds with lacerated external wound.
- ❖ Stab wounds have more depth than the length.
- ❖ Mechanism: The force is delivered with long axis of the weapon. A stab wound may be caused in 2 ways (a) by thrusting a weapon into the depth of the body and (b) the body may be pressed against or falls against the instrument.

Types of Stab Wound

1. Punctured
2. Penetrating
3. Perforating



1. Punctured Wound

- ❖ It is a stab wound which terminates in muscle. It is caused by pins, needles, syringe, therapeutic injection and snake bite.
- ❖ If the dagger is thrust into the thigh it cause puncture wound.

2. Penetrating Wound

- ❖ The weapon enters into a body cavity (thoracic, abdomen and skull).
- ❖ Thus, it produces only one wound that is entry wound either in chest cavity, abdomen or skull.
- ❖ These wounds may enter the internal organ.
- ❖ There may be incised penetrating or lacerated penetrating wound on the body depending on the weapons which produce the wound.

Examples:

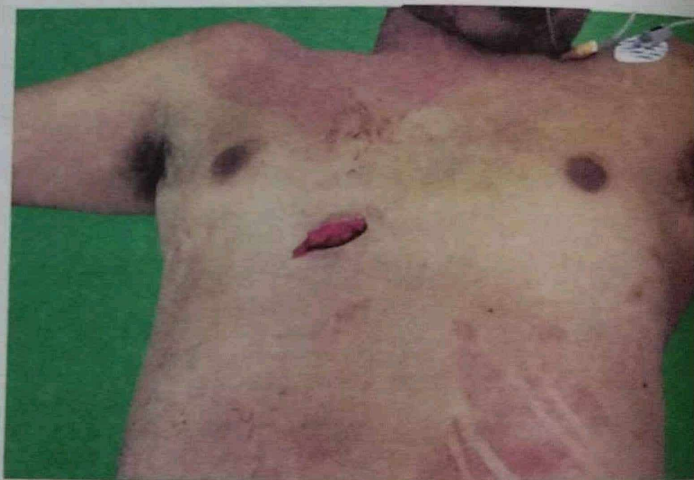
1. Stab wound in the chest or abdomen by knife or dagger having no exit.
2. Gunshot injuries in the head having no exit wounds.

3. Perforating Wound

- ❖ When a weapon enters the body on one side and comes out through other side, it can be called a perforating wound.
- ❖ It will have an entry wound and an exit wound.
- ❖ The entry wound is usually larger and inverted and the exit wound will be smaller and everted due to the tapering of the blade.

Characteristics of an Incised Penetrating Wound

1. **Margins:** Normally the shape is slit like with two acute angles. The margins are cleanly cut. Blood infiltration at the margins are minimal. If there is full penetration of the weapon, an abrasion can be produced by the touching portion of the hilt of the weapon on the skin. This is called hilt mark.



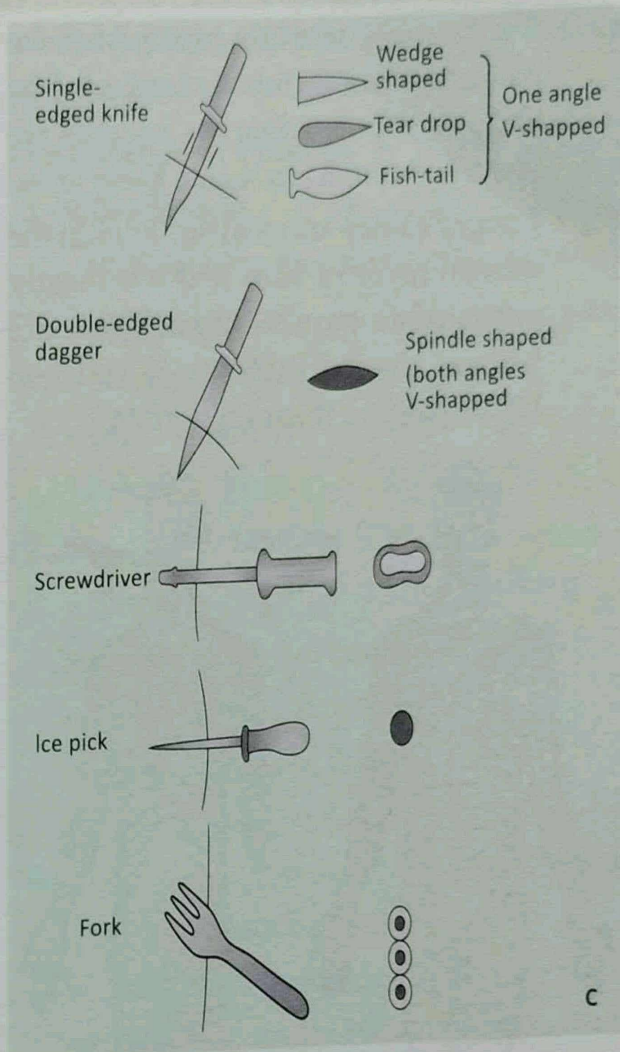
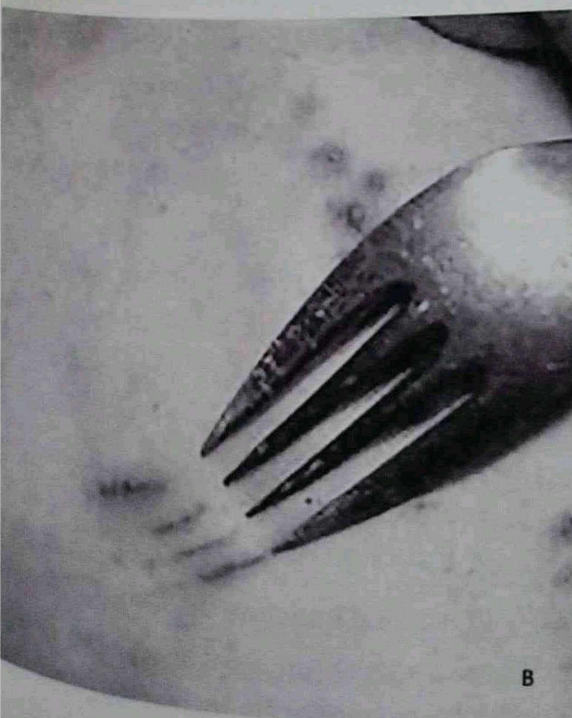
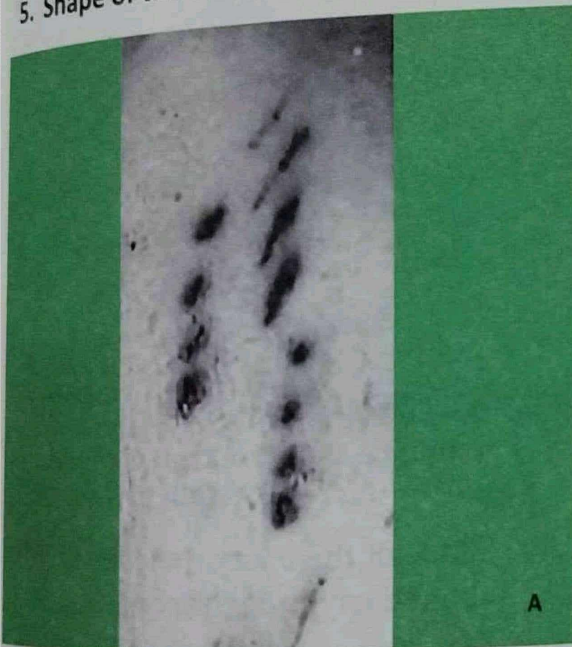
2. **Length:** From the length, get an idea about the width of the weapon. The length of the stab wound is normally less than the width of the weapon. Reason due to contraction of severed elastic fibres leads to gaping of wound and length decreases.

3. **Width of wound:** Width of the external wound does not correspond with the thickness of the weapon. Width depends upon the elasticity of the skin and muscular pull at the region. So the length of the wound should be measured

by the approximating the margins of the wound.

4. **Depth:** Depth refers to the length of the blade of the weapon. Depth is more than the length of the wound. In some cases like yielding sites like abdomen, the depth of the wound may be more than the length of the blade of the weapon. In such cases, hilt mark may be seen on the external wound.

5. Shape of the Wound:

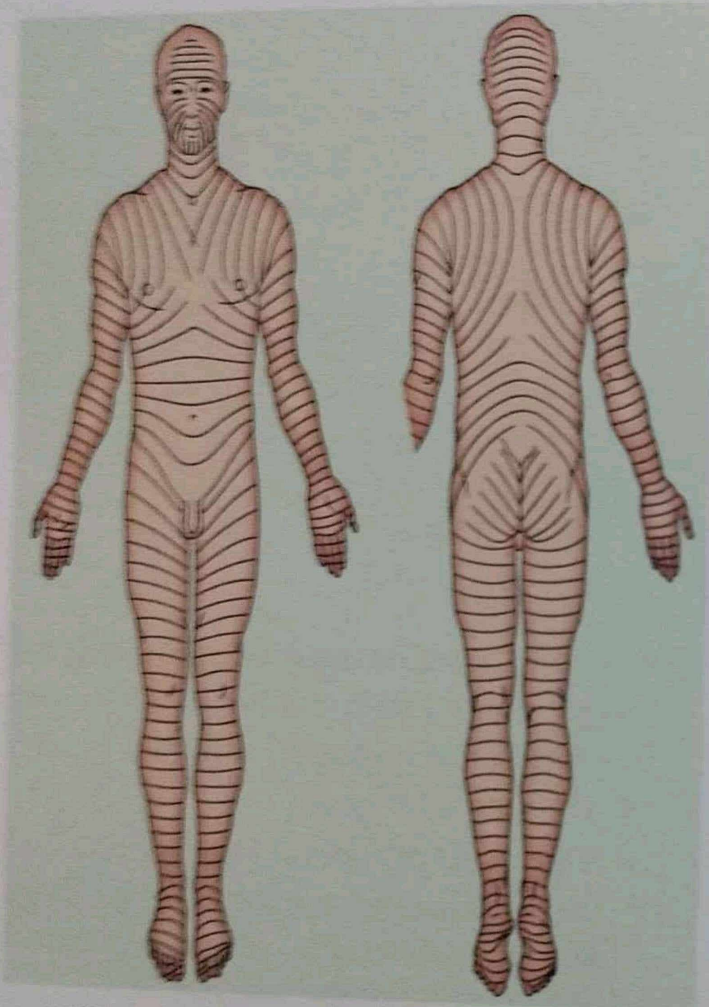


In case of, **single edged weapon**, shape is wedge shaped with one end of the wound is sharply cut and the other end is split or rounded or blunt.

- Sharp end of wound is produced due to the contact of sharp edge of weapon, and the split end is due to the contact of blunt end of the weapon.
- There may be gaping of both margins and this may rise to a **tear drop** appearance of wound.
- During withdrawal of the weapon, the blunt end may show small splits on either side called **fish tailing**.
- The knife which has one sharp edge and a thicker blunt edge produces a wound which is usually **wedge shaped**.

Double edged weapon: It usually produces a **spindle shaped** wound.

- The ends may be split or gaping when the wound passes vertical to Langer's line and less gaping when the wounds are passing through parallel to these lines.
- Langer's lines are cleavage lines in the dermal layer of skin and are mostly arranged in parallel rows. These are formed due to bundles of collagen fibrils passing through dermis.



Different shapes of the Weapon

1. An ice pick – Lacerated puncture wounds
2. A pointed square shaped weapon – Cross shaped injury,
3. Screw driver – Slit like stab with square ends and infiltrated margins
4. A round blunt object produces a circular wound with contused and inverted margins
5. An arrow or spear produces circular wound

6. Stab wounds by broken bottles may cause clusters of lacerated wounds of different size, shape and depth with different margins

6. Direction: Direction of wound can be found out by noting the direction of the wound track.

Complications and causes of Death

1. In stab wound, the external haemorrhage may be less, but the internal haemorrhage is more. It leads to hypovolemic shock
2. Cerebral anaemia
3. Direct penetration into heart
4. Air embolism when the wound cuts the jugular vein
5. When the wound enters the chest cavity, pneumothorax may occur
6. Asphyxia due to aspiration of blood if the trachea is cut
7. Wound may get infected
8. Vasovagal shock
9. Pneumonia as a secondary complication

MLI

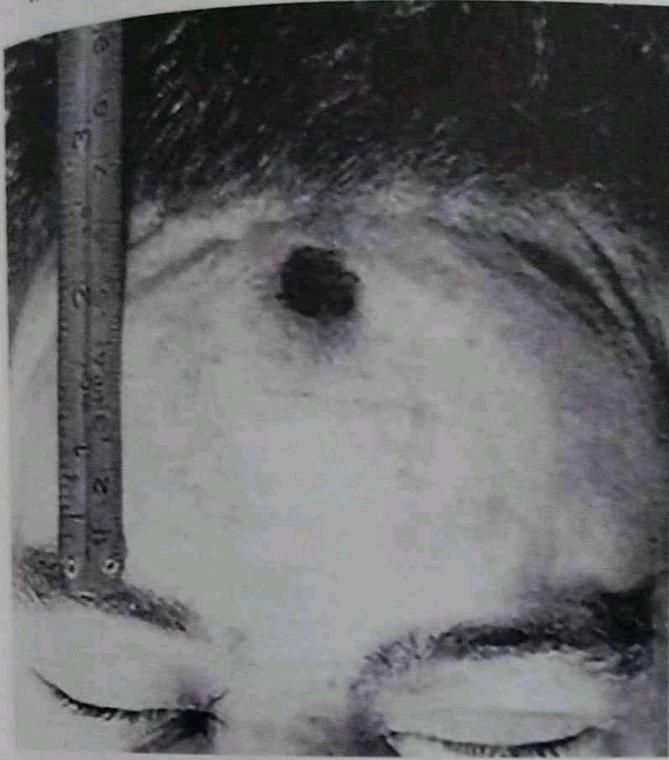
1. Shape of the injury indicates an idea about the type of weapon
2. Direction of wound will indicate the relative position of the victim and assailant
3. Depth of wound indicates the amount of force used. More depth favours homicidal in nature
4. Manner of production: Homicidal, suicidal or accidental
5. More number of wound indicates greater intention to kill (murder) for example in revenge
6. Age of the wound indicates the time of infliction of injury

7. Concealed Puncture wounds (CPW)

These are the homicidal needle punctures which are frequently inflicted at unusual

sites to hide their locations, e.g. nape of neck, axilla, fornix of upper eyelid, inner canthus of eye, nostrils, ears, under fold of female breast, vagina, and rectum.

Needle punctures are common methods of infanticide through fontanelle



21.3 Firearm Injury

Firearm Injuries

Introduction

Forensic ballistics: It is the branch of forensic medicine dealing with the investigation of firearms, ammunition, and the problems arising from their use.

Firearm: Is any weapon, which discharges a missile by the very expansive force of the gases produced by the burning of an explosive substance, is called firearm.

Proximal (internal) ballistics: It is the study of firearms and projectiles.

Intermediate (exterior) ballistics: It is the study of motion of projectiles after it leaves the gun barrel till the time it hits the target.

Terminal ballistics: It involves the study of behaviour of missiles, once they penetrate their target.

Wound ballistics: It is the study of the effect of missiles on living tissue.

Classification of Firearms

1. Rifled firearm

- **High velocity:** Shoulder arm-e.g. rifle. Automatic weapon e.g. Machine gun, Sten gun, etc.

- **Low velocity:** Hand arms-e.g. revolver, pistol

2. Smooth-bore firearm (shot gun)

- Single barreled or double barreled
- Breech loader or muzzle loader
- Cylinder bore or choke bore

3. Air or gas operated firearm

- Generally it is referred to as air guns, since most often, compressed air is used to propel a projectile.

4. Country made firearm: These are crude, smooth bore weapons but can be lethal.

(See the fig next page)

Rifled Firearm Injury

Entry Wound

The distance between the muzzle end of the firearm and target is called **range**. This may be:

- ❖ **Contact range:** If the muzzle end is in contact with the body.

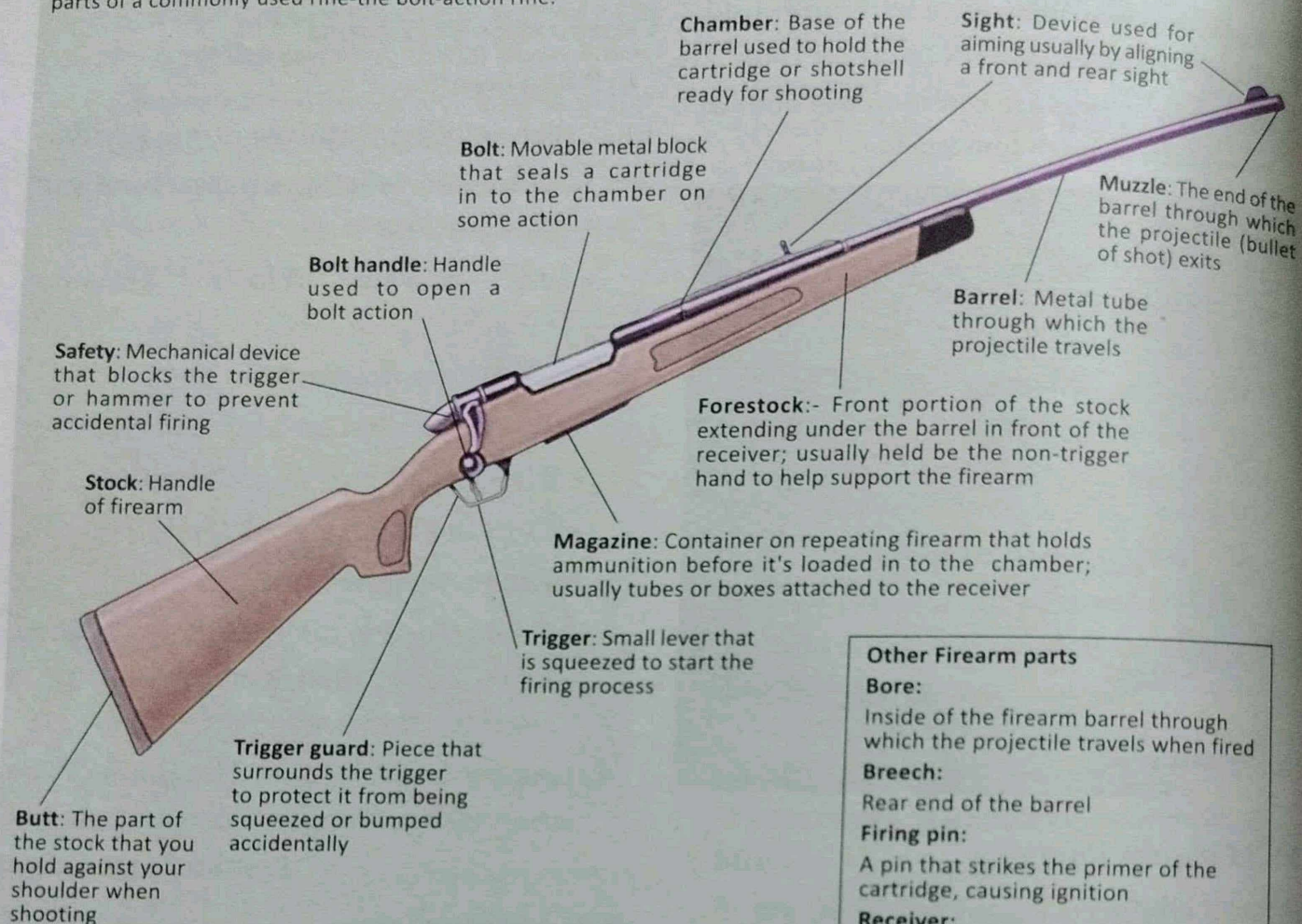
- ❖ **Close range:** If the range is within the distance, travelled by flame (extends up to 8cm).

- ❖ **Near range:** It is within the distance travelled by unburnt or partially burnt gun powder (40-50cm in hand guns and 60-100cm in rifles).

- ❖ **Distance range:** It is beyond the range of flames, smoke and gunpowder particles.

Parts of a Bolt- Action Rifle

Rifles, shotguns, and handguns have many similar parts. Shown here are the parts of a commonly used rifle-the bolt-action rifle.

**Other Firearm parts****Bore:**

Inside of the firearm barrel through which the projectile travels when fired

Breech:

Rear end of the barrel

Firing pin:

A pin that strikes the primer of the cartridge, causing ignition

Receiver:

Metal housing for the working parts of the action

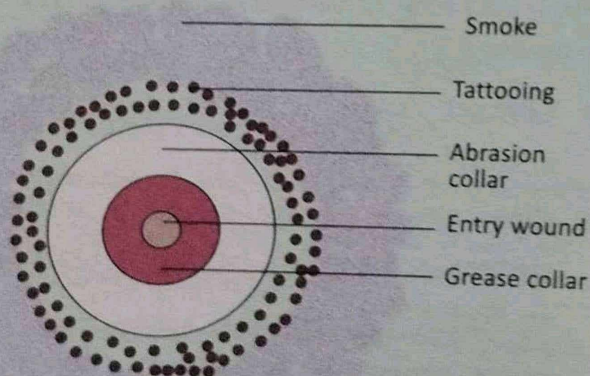
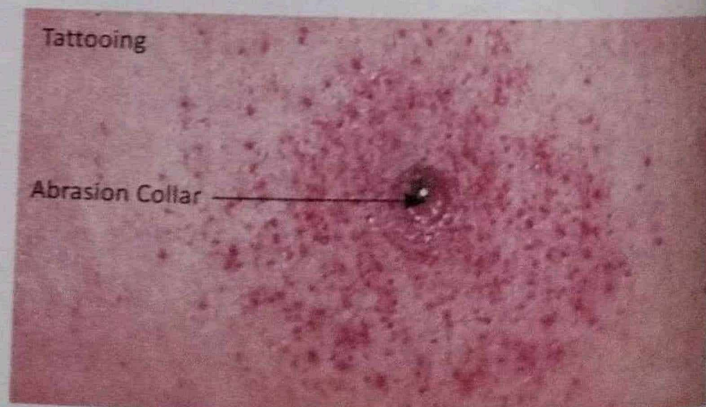


Fig: Fire am injury

spin the edge of the entrance wound may be abraded in the form of a collar, called **abrasion collar or areola**



❖ During the bullet's attempt to perforating the skin on entering the body, due to the

❖ In some cases, there is contusion instead of abrasion; it is called **contusion collar**

- ❖ The diameter of the entry hole together with the abrasion collar may give the approximate diameter of the bullet.
- ❖ The barrel of the firearm is normally lubricated between uses. When firing, the bullet as it is propelled through the barrel would naturally carry the lubricant grease, which subsequently gets deposited on the skin, around the entrance wound. This is called **grease or dirt collar**.

- ❖ **Burning/scorching/singeing** of the skin and hair result from the flame that emerges from the muzzle at the time of firing. Clothing around entry wound may also show evidence of burning.

- ❖ **Tattooing/peppering:** It results from the grains of gun powder being driven into the skin, each grain acting as a minute missile. Tattooing is seen on the skin as a small, discrete, black specks which cannot be wiped off. The extent of tattooing will depend on the weapon's caliber type and range. This may be absent when firing occurred through clothing.



Fig: Smudging

- ❖ **Lead ring or metal ring:** Seen around the entry wound, it results from deposition of very small quantities of lead or other metal in the form of a ring or collar as the projectile enters the skin. The lead ring can be appreciated neurologically or by Neutron activation analysis.

Contact Shot

- ❖ The firearm is placed in contact with the skin or clothing. A contact wound over a dense area such as vault of the skull is generally large and cruciate (star shaped) form due to explosive effects of the gases formed.
- ❖ The imprint of the muzzle of the weapon may be found stamped on the skin.
- ❖ Burning, blackening (smudging) and tattooing are slight or may be absent in the adjacent skin, since all the components of the explosions are driven into the wound

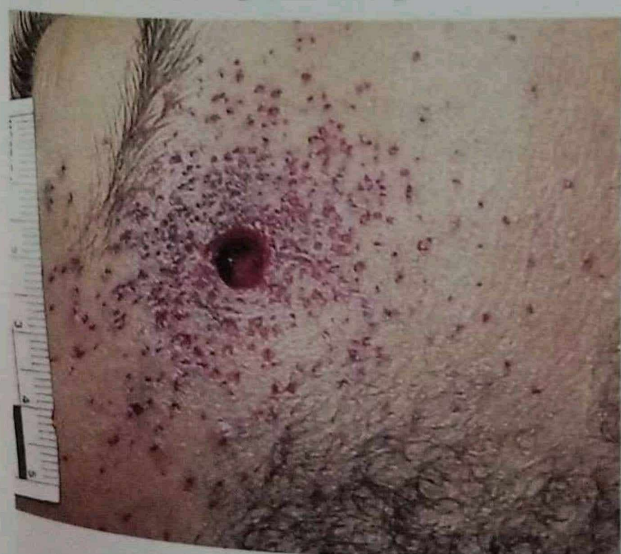


Fig: Tattooing

- ❖ **Blackening or smudging:** It results from superficial deposits of the smoke on the skin. It is only the carbon particle deposition on the skin and can be easily

- ❖ Tissues around the wound are seen with cherry red colour due to carbon monoxide poisoning.
- ❖ Contact wound over a thin bone, chest or abdomen may be circular in shape, and are surrounded by abrasion or contusion collar.
- ❖ The overall diameter of the hole plus the collar represents the approximate diameter of the bullet.
- ❖ The hairs surrounding the wound is also singed.

Close Shot

- ❖ The firearm was fired within the range of flame and powder blast but was not in direct contact with the skin or clothing.
- ❖ The wound appears as a circular hole surrounded by scorching, singeing, blackening and tattooing. Abrasion collar and grease collar are present.

Near Shot

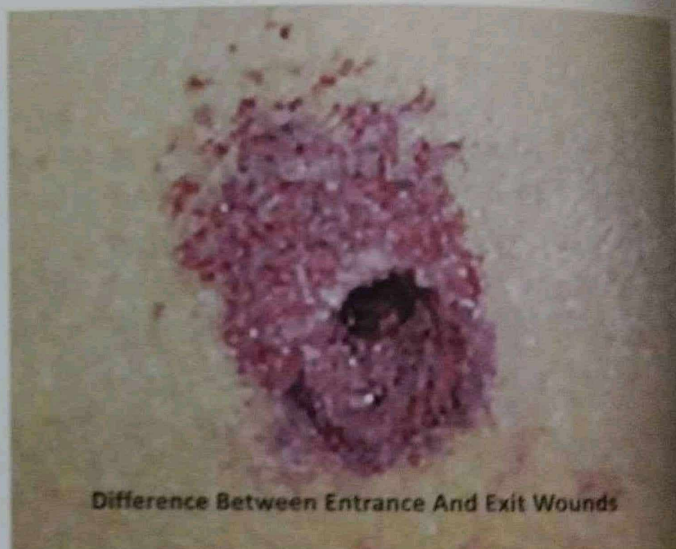
- ❖ It means the firearm was fired outside the range of flame, but within the range of powder blast.
- ❖ The entry wound is circular or oval in shape.
- ❖ Grease collar and abrasion collar are present, but singeing of hair and scorching is absent.

Distance Shot

- ❖ It means the firearm was discharged outside the range of flame, and powder blast.
- ❖ The entry wound is circular with inverted margins.
- ❖ Scorching tattooing and blackening are absent.
- ❖ Grease collars and abrasion collar are present.
- ❖ Distance shot suggests a range beyond self-infliction.

Difference Between Entry Wound and Exit Wound

Features	Entry wound	Exit wound
Size	Smaller than the diameter of the bullet	Larger
Edges	Inverted	Everted
Abrasion and grease collar	Present	Absent
Burning, blackening, tattooing	May be present	Absent
Bleeding	Less	More
Fat extrusion	Absent	May be present
Cherry red	May be present	Absent
Lead ring	May be present	Absent



Difference Between Entrance And Exit Wounds

Fig: Bullet Entrance Wound



Fig: Bullet Exit Wound

Entry Wound Contact Wound

- ❖ The contact shot wound in case of shot gun is usually large, irregular hole, resulting from explosive blast effect.
- ❖ The edge of the defect is scorched by flame, and the skin surrounded by it is blackened by smoke and tattooed by unburnt powder.
- ❖ An imprint abrasion produced by muzzle end may be seen.
- ❖ The injured tissue is usually cherry red in colour.
- ❖ Shot gun injury of the cranium is large and irregular and fissured fractures often radiate outwards from the margins. Sometimes the part of the head may be blown off.

Close Shot

- ❖ This produces circular defect with irregular inverted borders.
- ❖ The edges are scorched due to flame and smudged by smoke.
- ❖ Tattooing is also present.

Near Shot

- ❖ The wound is circular and oval in shape.
- ❖ Tattooing is present over a wider area.

Distance Shot

- ❖ Beyond a range of 2 meters, there will not be any burning or blackening.
- ❖ Tattooing is also rare.
- ❖ At distance range beyond 6-10 meters, the central hole may shrink to nothing. At such ranges, the shot may not be lethal and the pellets, if they do not penetrate the skin at all, may lie just in the subcutaneous tissue.

Exit Wound

- ❖ Exit wound varies greatly in size, shape and configuration.

- ❖ They are usually larger than the corresponding wound of entry.
- ❖ Scorching, blackening and tattooing are absent.
- ❖ Abrasion and grease collars are also present.

Medicolegal Aspects

- ❖ Legally firearms are classified as dangerous weapons, and mere possession without licence or authority becomes a cognisable offense.

The following are the important medico-legal issues:

1. The nature of firearm
2. The range of fire
3. The direction of fire
4. The place from where firing took place
5. The cause of death
6. Whether firing was accidental, homicidal or suicidal

The Nature of Firearm

- ❖ Whether the firearm used was a rifled weapon, or a smooth bore weapon. And if it was a rifled weapon or whether it was rifle, pistol or revolver.
- ❖ An examination of the size of the bullet, and its weight and caliber, number size and direction of rifling marks on it, and the kind of metal it is made of gives clue about the weapon.
- ❖ Bullets recovered at the scene of shooting incident, or from the dead body during autopsy.

Autopsy Procedure in Firearm Injuries

- ❖ This is very unique and collection of evidence material is also very important.
- ❖ Immediately after receiving the body from the police, attempt must be done to collect the primer from both the hands separately.

- ❖ Punctures, stains in the clothing must be noticed very carefully and photographed, clothes must be carefully removed and dried in shade and packed in paper bags
- ❖ External injuries must be noted and photographed and entry wounds should be swabbed with absorbent cotton soaked in rectified spirit.
- ❖ The dead body should be extensively x-rayed, and wet x-ray film must be examined before autopsy.
- ❖ All skin wounds should be dissected carefully with surrounding tissue.
- ❖ As the bullets recovered from the body should not be washed, or cleaned, as this may remove the residues adhering in the bullet. It should be dried without using heat and preserve carefully. Bullets need to be handled carefully, forceps or other metallic instruments must not be used as it causes artefacts or scratches. Rubber tipped forceps are best for handling projectiles.
- ❖ The size, weight, number, caliber, and direction should be noted.
- ❖ If the nose is blunted, it indicates that it had hit against a hard object.

Cause of Death

- ❖ Firearm injury can result in death due to haemorrhage, or damage to any of the vital organs such as the heart or the brain.

Manner of Death

- ❖ It must be deduced as to whether a particular case of the firearm death was accidental, suicidal or homicidal.
- ❖ Usually death from suicidal or homicidal accidental cause is less.

(see the table down)

21.4 Thermal Injury

Injuries also happen due to application of excessive heat or cold.

Classification of Thermal Injuries

Hypothermia (injuries due to cold)	Hyperthermic injuries (injuries due to heat)
A. Local • Without tissue freezing e.g. chilblains, trench foot • With tissue freezing • E.g. frost bite, frostnip B. Systemic • Hypothermia	A. Local effects (burns) • Dry heat burns • Moist heat burns • Burns by electricity, lightning, corrosives, radiation (sun burns, x-rays, UV rays, infrared rays, microwaves) B. Systemic effects • Heat cramps • Heat exhaustion • Heat syncope • Heat stroke

Features	Accidental	Suicidal	Homicidal
Site of entry wound	Any part	Head or chest	Any part
Range	Close	Contact or close	Any range
Direction	Any direction	Upward or backward	Usually upward
Number of wounds	One	Usually one	One or multiple
Firearm residues on hand	Present	Present	Absent
Weapon at the scene	Present	Present	Usually absent
Location	Anywhere	Usually home	Anywhere
Sex	Usually males	Usually males	Either sex
Motive	Absent	Depression, mental illness	Robbery, revenge

Hypothermic Injuries

Local Hypothermic Injuries

No tissue freezing

Chilblains (erythema pernio): They are non-fatal injuries with no forensic importance. It occurs due to the exposure of cold temperature, constriction of capillaries, especially in extremities causes red, inflamed, painful itching skin lesions. also causes edema and blistering. To reduce symptoms elevate the affected extremity and allow it to warm gradually.



Fig: Hyperaemia

Trench foot (or immersion syndrome)



Fig: Trench foot

❖ It usually occurs in soldiers during warfare, especially in trenches.

❖ Mechanisms:

Due to prolonged exposure of feet to cold, (non-freezing temperature of 5°C to 8°C) and wet condition, feet become blue (cyanotic) or red (erythrosis), swollen and numb and later on blisters appears and open sores. This may further lead to fungal

infections. Tropical ulcer and gangrene and it may require amputation.

Management

- ❖ Avoid trauma, and thus secondary infection.
- ❖ Gradual rewarming by air drying.

Local Hypothermic Injuries

Frost bite (congelation) - it is due to exposure to dry heat



Fig: Frostbite of fingers

It is commonly seen in mountaineers

Mechanism

Exposure of temperature 1-5°C to -10°C, which is freezing, causes the formation of ice crystals in tissues, obstruction of blood supply in tissues, and thereby vasospasm, ischemia, and localised necrosis.

- ❖ Bluish or black or purple or white skin of fingers, toes, nose, ears, cheeks or chin
- ❖ Burning sensation and pain occurs followed by progressive loss of numbness
- ❖ Blisters, necrosis and gangrene are formed

Medicolegal Importance

- ❖ It is an ante-mortem phenomenon

Systemic Effect

Hypothermia

It is a state where the body (core) temperature falls less than 35°C. Dry cold is better tolerated than wet cold since wetness absorbed heat considerably.

Incidence

- ❖ People with myxedema and hypopituitarism, infants, elderly and malnourished are more susceptible to exposure of cold.
- ❖ Intoxicated persons (alcohol, tranquilizers and opiates) and People invalid in mountaineering and sailing activities are susceptible.

1. First stage (mild Stage)

- When the body temperature is below 35°C, the patient feels cold, shivers and the body temperature falls.
- Recovery is possible at this stage using warm clothing and exposure to heat.

2. Second stage (Moderate stage)

- Shivering stops when the temperature is at or below 33°C.
- The victim is depressed, lethargic and drowsy.
- The muscles become stiff, mobility is impaired and the person may feel as he is drunken.
- There may be disturbance in consciousness and hallucinations.
- Decreased heart rate, respiratory rate, blood pressure, facial edema and red patches on the skin.
- Below 30°C, there may be paralysis of thermoregulatory system resulting in failure of vasoconstriction which gives a feeling of exaggerated sensation of warmth, and terminal hallucination occur. Because of this great discomfort, person may undress himself and which is called as paradoxical undressing.

3. Third stage (severe) temperature less than 30°C

- Increased muscular tone
- Bradycardia
- Coma

4. Fourth stage

- Temperature less than 27°C
- Suspended animation, failure of vital centres, coma, respiratory failure and ventricular fibrillation

Postmortem AppearanceExternal

- ❖ Skin is pale with irregular patches of redness and blisters.
- ❖ Puffiness of face and generalised edema.
- ❖ Postmortem lividity is pink/bright red due to deoxygenated blood.

Internal

- ❖ Generalised congestion of organs and bright red colour due to oxyhemoglobin
- ❖ Trachea contains frothy and sanguineous fluid.
- ❖ Stomach: Mucosa frequently studded with numerous characteristics such as shallow blackish, brownish, petechial haemorrhages and erosions is called **Wischnewsky's spots**.
- ❖ Heart: Dilated right atria and ventricles
- ❖ Lungs: Pulmonary oedema
- ❖ Kidneys: Acute tubular necrosis
- ❖ Pancreas: Acute pancreatitis and fat necrosis

MLA

- 1. Paradoxical undressing:** If a person trapped in an extremely cold environment just before his death, he takes off his clothes. It is a terminal event and mostly found in old people.

It occurs due to paralysis of thermoregulatory system as a result, body may no longer be able to initiate mechanism such as shivering and vasoconstriction [narrowing of blood vessels to conserve heat]. As a result, the body may

paradoxically dilate blood vessels near the skin, blood flow to peripheral vessels, leading to the sensation of warmth on the surface while the core body temperature continues to drop. So the person feels spurious, warmth and starts undressing himself without being aware of the fact that his body temperature is continuing to decrease.

Most deaths are accidental, and rarely homicidal.

2. Hide and die syndrome

If a person is trapped in an extremely cold environment, he tries to hide himself in corners and cupboards, behind the wardrobe and under tables, benches, and piles.

3. Alcohol and hypothermia:

Consumption of alcohol produces vasodilation and increases blood flow to the skin and extremities, making a person feel warm with increasing heat loss. It lowers the core temperature. It results in consumption of more and more alcohol to keep oneself warm.

4. Cold stiffening

Body become stiff/rigid/due to body tissues and fluids. When the body shift from cold to warm condition, the initial rigidity of cold stiffening passes off and then rigor mortis appears rapidly and disappears rapidly.

MLI

- This indicates the situation where the body is **exposed after death**.
- It helps in indication of **cause and manner** of death as situation preserves the body well.
- It should be differentiated from rigor mortis.

5. Hypothermic injuries: They are usually accidental and homicidal. Method of

physical torture to extract confession: The person is put in an ice block until he yields.

6. Therapeutic hypothermia (controlled, induced hypothermia):

It is utilised in transplant cardiac and cranial surgeries.

Hyperthermia

Systemic Hyperthermia

Heat disorders	Features	Skin
Heat cramps	Muscular contractions and spasms, due to loss of salt	Moist and cool
Heat exhaustion	Dizziness/weakness. due to loss of water and salt	Moist and hot
Heat syncope	Fainting/ dizziness the person collapses	Moist and cool
Heat stroke	Loss of thermoregulatory Mechanism: temperature is raised to 41°C	Dry and hot

1. Heat cramps/miner's cramps/stoker's cramps/ fireman's cramp

- ❖ **Cause:** Prolonged heavy exercise, heavy sweating and drinking excessive water **without salt (dilutional hyponatremia) in extreme heat are its causes.**
- ❖ Sudden severe and painful paroxysmal skeletal muscle contractions or spasms, especially those of extremities and abdominal wall lasting 1-3 minutes +dizziness, tinnitus headache and vomiting.
- ❖ Skin moist and cool, pupils dilated
- ❖ It is due to loss of sodium in sweating
- ❖ Mostly seen in people who works in mines, stokers, factory workers and mountain climbers.

- ❖ Management: Shift the patient to a cool environment, salty drink, rest and IV fluids.

2. Heat exhaustion/heat prostration/heat syncope/heat collapse

- ❖ This is the circulatory disorder resulting from exposure to high temperature and humidity.
- ❖ Clinical features: The person will sweat profusely, which causes loss of salt and water.
- ❖ Other symptoms includes: Headache, fatigue, confusion, drowsiness, visual disturbance and vomiting.
- ❖ It is followed by circulatory collapse characterised by pallor, sweating, hypotension and lactic acidosis.
- ❖ Pupils are dilated, pulse because weak and respiration is low.
- ❖ The temperature is subnormal

- ❖ This is rarely fatal

- ❖ Management: Shift the patient from hot atmosphere, bed rest, replacement of water and electrolytes, ORS.

(See the fig Down)

- ❖ Heat stroke or sun stroke: It is a type of systemic hyperthermic injury or medical emergency in which there is complete absence of sweating and the temperature is raised to 41°C .
- ❖ Mechanism: **Loss of thermo regulatory mechanism situated in Hypothalamus**
- ❖ Predisposing factor: Physical exertion under conditions of **high temperature and humid environment** with lack of acclimatisation, infection, old age, thyrotoxicosis, alcohol, obesity, unsuitable clothing, etc. are predisposing characters.
- ❖ The body temperature is increased more than 41°C and the patient will have disorientation, delirium, stupor, convulsions and coma.

3. Heat Stroke (Sun stroke/ heat hyperpyrexia)

6 Signs Of Heat Stroke



Not sweating (dehydrated)



Dry, hot, red skin



Dizziness, headache



Incoherence, unconsciousness



Nausea, Vomiting



Fast, strong pulse

- ❖ The term "thermic fever or sun stroke" is used when there is direct exposure to sun.

Clinical Features

- ❖ It may be present in 2 forms: (1) An acute form with sudden onset without any prodromal symptoms and (2) a gradual onset form without prodromal symptoms like headache, nausea, vomiting, dizziness, confusion, disorientation, delirium, psychosis, and weakness in legs.
- ❖ The temperature rises up to 40°C-43°C or more.
- ❖ The skin is dry, hot, and flushed without sweating.
- ❖ Pupils are constricted
- ❖ Pulse is rapid weak and later becomes irregular.
- ❖ Breathing is rapid (Kussumaul's breathing), respiratory alkalosis.
- ❖ Urine is scanty and turbid
- ❖ Patient becomes deliriant and unconscious and convulsions occur before death.

Fatal period: **5 minutes to 3 days.**

Management

1. Lower the temperature by passive cooling (move to a cooler area) and active cooling methods (cold water baths, cold compress, immersion in ice water tubs).
2. Medicines: Diazepam, chlorpromazine etc.
3. Fluids: Oral or IV for increasing the urinary output.

Autopsy findings: Almost similar as cardiac failure

1. **Postmortem caloricity:** The temperature after death is high.
2. Rigor mortis establishes early and passes off early.
3. Putrefaction is rapid

4. Visceral congestion and haemorrhages.
5. **Heart:** Flabby, sub-endocardial haemorrhages.
6. Lungs congested, and haemorrhagic with petechial haemorrhage.
7. Brain congested and edematous
8. **Liver:** Congested with centrilobular necrosis.
9. **Kidneys:** Congested and oedematous.

MLA

1. **In case of sun stroke**, the person may pass into the stage of suspended animation, so resuscitation has to be considered before pronouncement of death.
2. **Unfavourable working conditions** at working place leading to hyperthermia, in which an employee can attract provisions of Workmen's Compensation Act.
3. **Death due to hyperthermia** is usually accidental but it may be created artificially. For example, malignant hyperthermia by drugs such as halothane.

Dry Heat Burns

- ❖ Burns are the injuries caused on the body by dry heat, heated objects, or chemicals and radiant heat.
- ❖ It causes coagulative necrosis of epidermis and underlying tissues.
- ❖ The minimum temperature for producing burn is 44°C – for 5-6 hours.
- ❖ At 65°C- 2 seconds are sufficient to make burns.
- ❖ Burns are characterised by hyperemia, vesication, singeing of hairs, and charring of tissues.

Classification of Burns

Clinical classification

- ❖ **Partial thickness burns**

- **Superficial partial:** Burn up to papillary dermis.

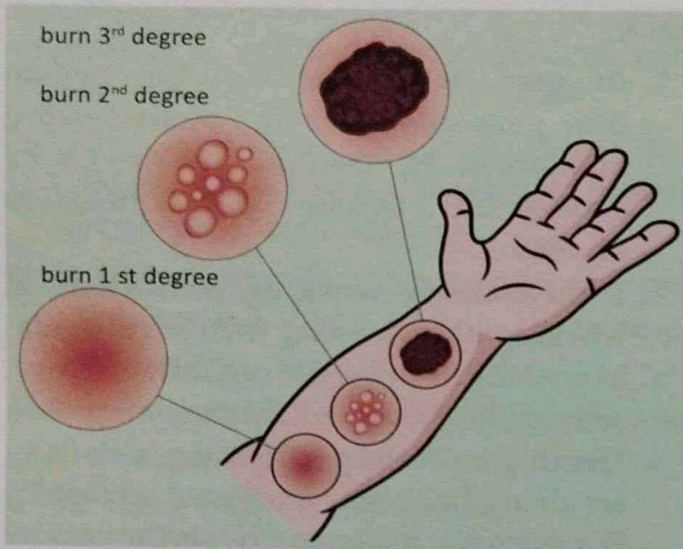
- **Deep partial:** Burns which are deep up to deeper parts of reticular dermis.

❖ Full thickness burns

- The burns involving full thickness of dermis and beyond

Pathological classification

Dupuytren's, Hebra's, and Wilson's classification. (See the table down)



Wilson's Classification of Burns

1. Epidermal burns: Only epidermis is involved Featured by

- ❖ Erythema capillary dilatation, and transudation of fluids into tissues and associated with swelling.
- ❖ Blister formation when fluid accumulates at dermo epidermal junction below epidermis.

- ❖ Singeing of hair present
- ❖ Painful
- ❖ Heal completely without scarring.

2. Dermo epidermal burns: Full thickness of skin is involved.

- ❖ Epidermis is coagulated and charred.
- ❖ There is a central shriveled and depressed zone of necrotic tissue which is surrounded by hyperemic cells.
- ❖ These bones are most painful because free nerve endings responsible for the pain are exposed.
- ❖ Heal with scarring: The contraction of scar tissue may cause disfiguration or impaired function.

3. Deep burns

- ❖ They include destruction of skin, subcutaneous tissues, muscles and bones.
- ❖ The burnt parts are completely charred.
- ❖ Burns are usually painless because the nerve endings are destroyed.

Estimation of burnt area (rule of nine)

- ❖ The severity of burns depends upon extent of burns assessed in percentage of burns on the body. Percentage of burn calculated as per Wallace rule.
- ❖ Rule of Nine

Classification of Burns

Damage	Dupuytren's classification	Hebra's classification	Wilson's classification
1. Erythema	First degree	First degree	Epidermal
2. Vesication	Second degree		
3. Damage to superficial skin	Third degree	Second degree	Dermo epidermal
4. Damage to whole skin	Fourth degree		
5. Damage to muscles	Fifth degree	Third degree	Deep
6. Damage to bones	Sixth degree		

- 9% for head
 - 9% for each upper
 - 9% for front of each lower limb
 - 9% for back of each lower limb
 - 9% for front of chest
 - 9% for back of chest
 - 9% for the front of abdomen
 - 9% for the back of abdomen
- 99%

The remaining 1% is for External Genitalia and Perineum

- ❖ The burns affecting head, neck, face and genitals more fatal.
- ❖ Woman and children are more susceptible.

- ❖ Infants and children: This calculation is not accurate as there is a difference in surface area (head-larger than lower limb).
 - ❖ In this, Lund and Browder's method can be used as follows:
 - ❖ For infants less than 1 year, head is 18%, each lower limb 13.5%, trunk and arms same like adults.
 - ❖ For each year, 1% is reduced for head and add 0.5% for each lower limb.
 - ❖ Surface area covered by area of palm is 1%
- (See the Fig next page)

Causes of Death in Burns

1. Neurogenic shock – Due to pain
2. Hypovolemic shock – Due to loss of fluid
3. Toxaemia – A result of absorption of toxic material from the burnt site
4. Septicemic shock – Due to infection
5. Suffocation – Due to inhalation of CO_2 , CO and other gases

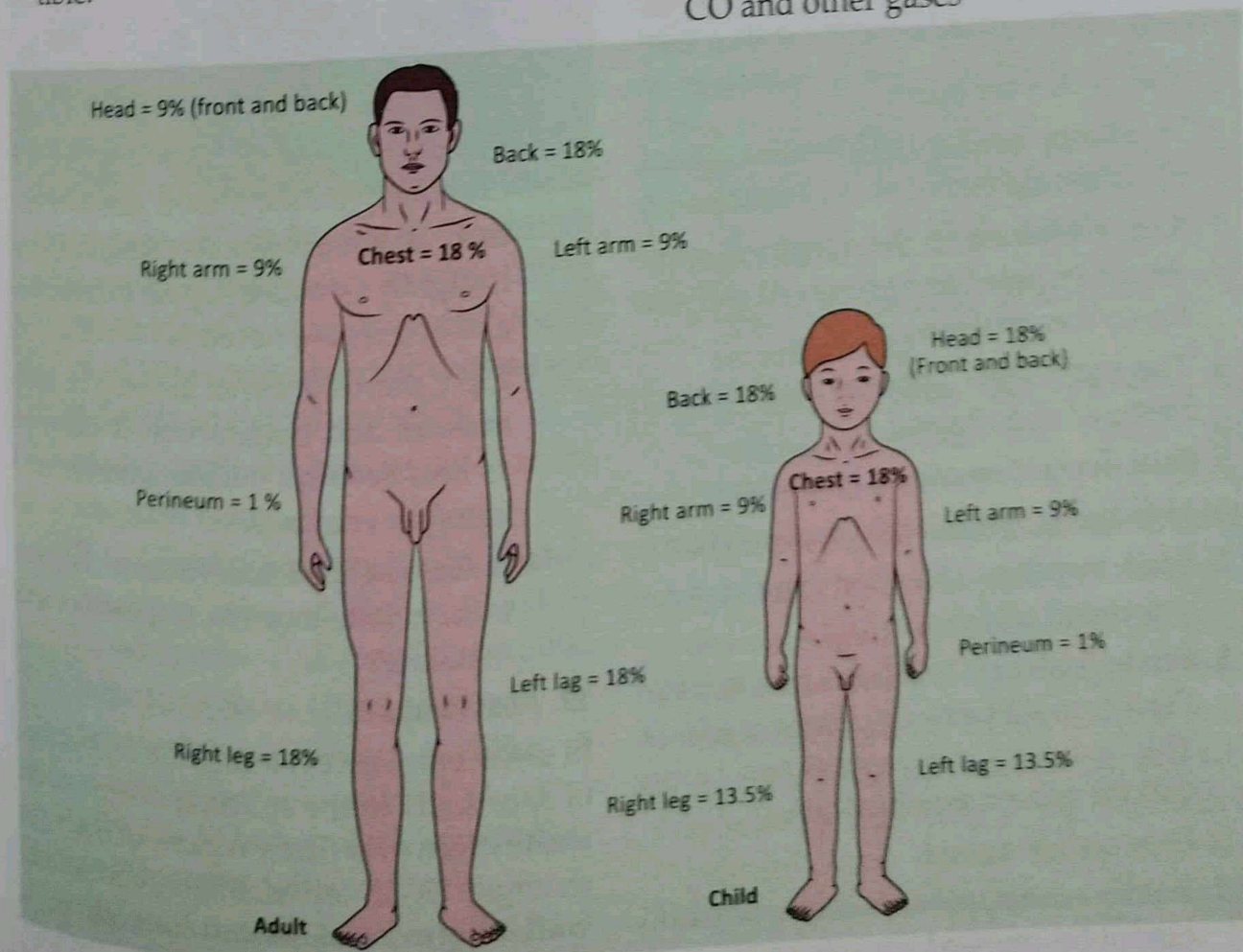


Fig: Rule of Nine

6. Laryngeal spasm and glottis edema induced by smoke, fumes or hot gases:
 - Death occurring within 24 hours usually due to neurogenic shock, hypovolemia and toxemia.
 - Delayed death which occurs after 72-96 hours are usually result of infection, or renal damage or haemorrhage from erosions (curling's ulcer- ulcers in the first part of duodenum) of GIT.
 - Death can also occur from smoke inhalation (carbon monoxide poisoning), mechanical trauma (due to fall).

Sequelae of Burns

- ❖ Malignancy may develop from a burn scar (marjolin's ulcer).
- ❖ Scars, keloid, corneal opacity, obliteration of external auditory meatus, joint deformity, ankylosis are other sequelae.

Autopsy Findings

External

1. The clothes are burnt
2. There may be smell of kerosene, petrol, etc. It should be noted.
3. Any container at the scene of crime should be noted and preserved and sent for further analysis.
4. The burnt area appears as reddened, blistered and charred.
5. Soot deposition causes blackening.
6. Hair may be singed and completely burnt.
7. Face swollen, distorted and tongue protruded and charred tips.
8. **Froth:** At mouth and nose, heat irritates the lungs and causes pulmonary edema. This indicates the antemortem nature that the person was breathing.
9. Eyes are congested
10. Postmortem hypostasis and rigor mortis cannot be assessed.

11. There may be heat rigor on the body, which is called pugilistic attitude, (boxing, fencing, defence attitude).

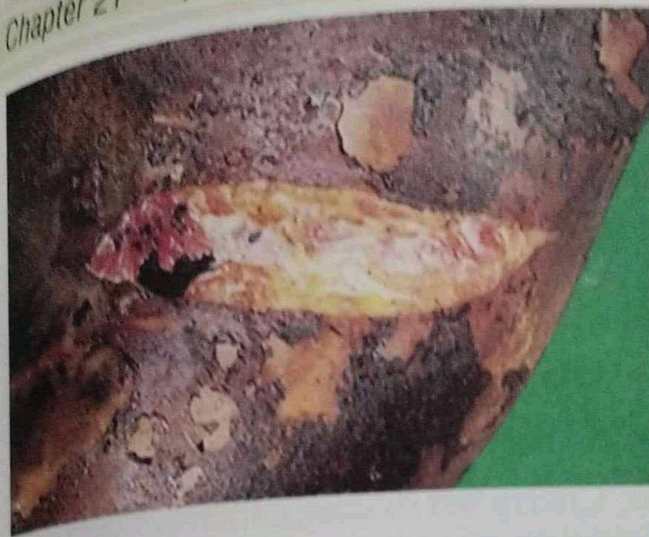


Fig: Pugilistic attitude

- This is due to heat coagulation of muscle protein and dehydration and contraction of muscles due to excessive heat.
- The posture of body is very characteristic. It is very similar to the posture of a boxer during defence, it is called boxer's attitude, fencer's attitude and defence attitude.
- In case of death due to burn, flexor muscle (more bulkier than the extensor) contracts more so that the body attains a position of flexion. Head is slightly extended. Upper extremities and fingers are flexed.
- Rigor mortis does not develop in such muscles and putrefaction is delayed as heat destroys microorganisms and autolytic enzymes.
- It does not applicable for ante-mortem burn is ante-mortem or postmortem in nature.

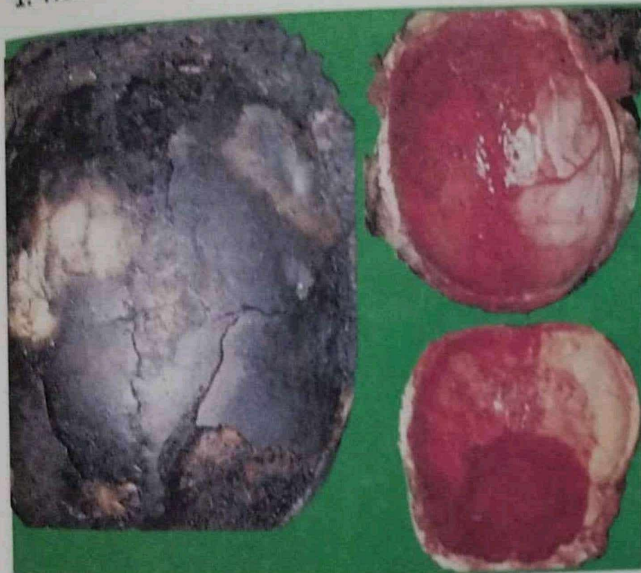
12. Heat Ruptures

In severe burning or charring, the contraction of skin leads to the splitting of soft parts usually seen over fleshy regions of body for example: Head, calves, thighs, abdominal wall, thighs, and joints. Externally, it resembles like lacerated wound.



Internal Features

1. Heat hematoma



- In case of death due to extensive flame burn injury, exposure of skull to tremendous heat leads to charring of skull. Beneath the charring, haematoma develops in Extradural space.
- Most commonly seen at the parieto temporal region.
- It is 1.5mm-1.5cm thick, soft friable, chocolate coloured clot of blood. If blood contains CO, the colour is pink.
- It contains about 120ml of blood.
- Intense heat produces bubbles of steam in the accumulated blood to give rise to honey comb appearance. So it becomes soft and friable.
- The brain near haematoma is hard and discoloured due to heat.

- The brain is shrunk, firm and yellow to brown due to cooking and the dura is leathery.
- Heat haematoma may resembles traumatic extra dural haematoma.

Features	Heat haematoma	Extra dural hematoma
Cause	Heat	Mechanical injury
Skull fracture	May be present	Usually present
Fracture line	Need not cross middle meningeal artery	Crosses
Position	Usually bilateral	unilateral
Appearance	Cherry red colour	Reddish purple
consistency	Soft friable	Firm
Adjacent brain	Shows heat effects	Injury
Presence of CO	Present	No
Soot particle in respiratory tract	Present usually	Not
Carboxy hemoglobin	Usually present	Absent

2. Heat Fractures of Skull

- Occurs in the areas of skull, which is severely burnt.
 - It usually does not involve the sutures of the skull, and it may cross a suture line.
 - It involves the outer table of the skull.
 - There is no displacement of the bone.
3. **Internal organs:** All internal organs are well preserved and cooked appearance.
4. **Respiratory system:** Hot smoke along with soot particles and carbon particles is inhaled by the victim, so the respiratory passage from mouth to bronchioles are congested, edematous with frothy mucus secretion.

5. Lungs congested and edematous.
6. **GIT:** Soot particle may found in the esophagus and stomach, curling's ulcer may be seen at duodenum.
7. **Carbon monoxide in blood:** Blood is Usually present with cherry red in colour. It may be absent in sudden death cases like explosions.

MLA

1. **Identification of Dead:** Identification is very difficult in case of extensive burns. It may be helpful if metallic object is worn, teeth examination, sex determination may be done by prostate and nulliparous uterus.
2. **Manner:** Accidental, homicidal or suicidal: Accidental burns are common in children and old people. Suicidal burns are common among Indian women. Homicidal is also common related with the matter of dowry.

3. Ante-mortem and postmortem burns

Features	Ante-mortem burns	Postmortem burns
Line of redness	Present	Absent
Blister	Contains leukocytes	Not contains leukocytes
Vital reaction	Cellular infiltration present	Absent
Enzymatic activity	Increase in enzyme reaction like, leucine-amino peptidase, acid phosphatase, esterase Present.	Not present
Colour of blood	Cherry red due to CO Hb	No cherry red colour
Soot particles	Present in respiratory tract	Absent

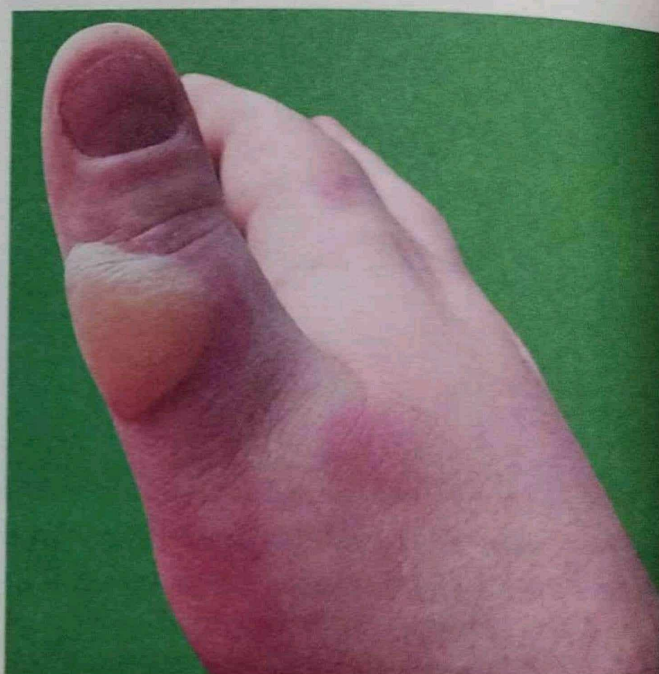
Features	Ante-mortem burns	Postmortem burns
Evidence of fat metabolism	May be seen	Absent

The surest signs of ante-mortem burns are :

- ❖ Vital reaction at the burnt margin.
- ❖ Soot particles in the air passages.
- ❖ Cherry red discolouration of blood.

Moist Burns – Scalds

Scalds



- ❖ Scalds are the injuries caused from application of moist heat, for example: any boiling liquid (e.g. water, milk, oil) or hot steam.
- ❖ The extent of tissues does not extent as deeply as in burns.
- ❖ A scald can be produced application of liquid with temperature more than 60°C. water at 70°C causes full thickness scald of skin in 2 seconds.

Types of Scalds

1. **Erythema :** Seen around the scald

2. **Vesication:** Blisters are formed within few minutes. If blistered skin is removed it leaves a pinkish raw surface which later becomes brownish, there is oozing of serum from the scalded area.

3. **Necrosis of dermis:** Skin will be suddenly bleached and there will not be any charring of skin. Hair will not show singeing:

- Sticky hot liquids like oil, tar, etc. cause severe scald than hot water.
- Scalds are severe at the site of initial contact with the liquid. As the liquid trickles down the body, the degree of scalding also decreases.

Postmortem Appearance

1. Clothes are wet but intact.
2. Streaks of liquid runs downwards from the main area causing lines of blisters.
3. Scald contains sharply demarcated margins which corresponds to the extent of fluid contact.

Cause of Death

- ❖ Shock (neurogenic or hypovolemic), and fluid and electrolyte balance.
- ❖ Delayed death due to infection.

MLA

1. Scalds are usually accidental in nature and mostly involve children.
2. Rarely suicidal
3. Sometimes it comes under grievous hurt: When the hot liquid is intentionally thrown to the face of victim. The face and head are disfigured permanently due to scarring and discolouration.

21.5 Dowry Death

Dowry Death

Legal sections related with dowry death are S.304B and 498A of IPC and S.113A and S.113B of IEA —

1. **S.304B of IPC:** Defines dowry death as death of a woman within 7 years of her marriage, under suspicious circumstances.

- This means dowry death (considered) is death of woman that occurs **within 7 years** of marriage and it must be proved that **cruelty or harassment** has occurred from the husband or his relatives before the death.
- It is cognizable, non-bailable and non-compoundable offence.
- Punishment: Husband and relatives involved in dowry death are punished as imprisonment of 7 years up to life imprisonment.

2. **S.113A of IEA (Presumption of abetment of suicide by a married woman):**

- If a woman in 7 years of marriage is subjected to cruelty by husband or relative and she commits suicide, the court shall presume abetment of suicide by the husband and relatives.

3. **S.113B of IEA (Presumption of dowry death):**

- In answer to the question whether the person has committed dowry death of a woman, and it is proved that soon before death there occurred cruelty or harassment for dowry. The court shall presume that such person caused dowry death.

4. **S.498A of IPC: Domestic Violence Act**

- Whoever being the husband or relative of the husband of a woman, subject such woman to cruelty shall be punishable with imprisonment for a term which may extend to 3 years and also liable for fine.

Dowry Prohibition Act 1961

- ❖ This Act prohibits demand of dowry, in India.

- ❖ India is having highest number of dowry death reported.
- ❖ This Act prohibits the giving or receiving dowry. As per this Act, dowry includes, property, goods or money given by either party to the marriage, by the parents of either party, or by anyone else in connection with marriage.
- ❖ This Act applies to all persons and all religions in India.
 - **Dying declaration:** If the condition of the patient is serious, the doctor should arrange to record her dying declaration.
 - **Magistrate inquest:** This is done in case of dowry death, especially be an executive magistrate.
 - **Manner of death:**
 - ♦ **Homicidal:** It includes burns, strangulation, and smothering, poisoning, stabbing and cut throat.
 - ♦ **Suicidal:** It includes hanging, drowning, poisoning, burning and cutting radial artery.
 - **Autopsy:** It should notice external injuries, ligature mark around the head injuries, neck, neck and dissection should be done, internal organs and uterus must be examined for any products of conception like female foetus
 - **Compensation:** The court must order the convict to pay a compensation for the woman's family

Electrical Injuries

Electrocution

It is the death caused by electric shock.

Electric shock: It is the sudden violent response to electric current flow through any part of person's body.



Factors determine the severity of electrical injuries

1. Current
 - Intensity of current
 - Amount of current
 - Path of current
 - Duration of current
2. Voltage
3. Resistance
4. Area of contact
5. Other factors

1. Current

It is the amount of electricity (electrons or ions) flowing through (body) in a second. It is measured by ampere or milli-amperes.

Intensity of current

- ❖ Ampere (intensity) is the important factor in electrical injuries than the voltage
- ❖ AC (alternate current) is more lethal than DC (Direct current)
- ❖ AC-70-100 mA = DC of 200-300mA
- ❖ AC causes tetanic muscle spasm & convulsions. It tightly adheres the victim in the wire while DC throws away the person.
- ❖ Commonly in household purposes is used AC.

Amount of current

- ❖ 1mA-tingling sensation
- ❖ 5mA-muscle tremors

- ❖ 16mA-maximum current an average man can grasp
- ❖ 20mA-paralysis of respiratory muscles
- ❖ 100mA-ventricular fibrillation
- ❖ 2A-cardiac stoppage and internal organ damage

Path of current

- ❖ Electricity flows from one point to another point (one terminal to another).
- ❖ The connection between the terminals of voltage source is called 'load'. It can be anything that conducts electricity, like person, bulb or anything.
- ❖ In the body, current takes the shortest path not necessarily the least resistance path.
- ❖ If the path connects brain and heart, it is fatal.
- ❖ The path of current from left hand to right leg is more lethal than the path from right hand to legs.

Duration of current

- ❖ The effects of current is more with the increase of duration.

2. Voltage

- ❖ It is the force that pushes electric current through the body.
- ❖ Low voltage (less than 50V) is used for therapeutic purposes.
- ❖ Household purpose (220-250V AC)- Most fatalities occur.
- ❖ If the current is low and the contact time is more, then death occurs due to muscle paralysis with secondary asphyxia.
- ❖ High voltages like more than 1000V, no contact with the body is needed and current arcs (jump) to the victim. It produces a very high temperature (4000°C) and death occurs due to respiratory arrest after the paralysis of respiratory centre.

3. Resistance

- ❖ Human body is a good conductor of electricity as it contains sodium, potassium and various ions.

4. Area of Contact

- ❖ Small area of contact like tip of finger exerts great resistance than large area like palm.

5. Other Factors

Dry or wet, conditions of the body and cardiac diseases

Electric Shock

1. Local effects

2. **Systemic effects:** Renal failure-Current causes damage due to release of myoglobin into urine (myoglobinuria) which causes kidney failure.

Management

- ❖ CPR if the person in suspended animation
- ❖ Use of defibrillator
- ❖ Treatment for kidney failure
- ❖ Treat the burns

Electrocution

- ❖ It is the death occurred due to electricity
- ❖ Causes of death: Ventricular fibrillation and cardiac arrest, prolonged ventricular fibrillation leads to hypoxia to the brain, brain damage. Another reason is respiratory centre arrest.

Autopsy Features

1. **Entry marks:** Electric burn at the point of entry is called as **Joule's Burns**.

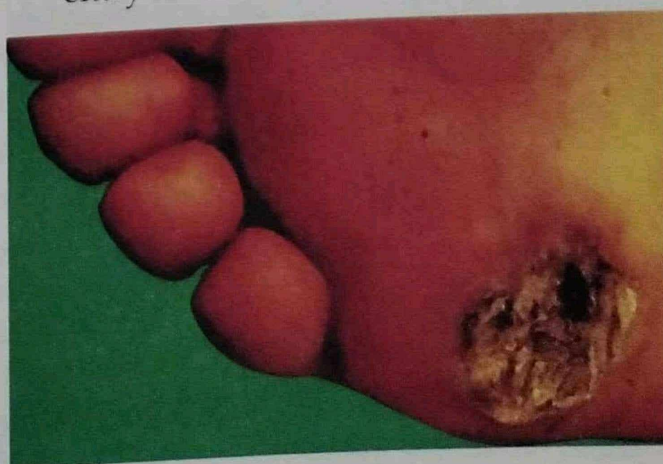




Fig: Entry marks electrocution

- ❖ When the current passes through the skin produces heat and causes heating of tissues and is called endogenous burns. Joule burn is **endogenous**.
- ❖ This mark is usually round or oval with **shallow crater with a ridge of skin** around.
- ❖ The crater appears pale and the intact skin adjacent to the mark shows **hyperemia** due to rapid dilatation of pre capillary vessels.
- ❖ When the contact is **prolonged**, there may be **charring** and may involve muscles and even bone.
- ❖ Occasionally the muscle may have the shape of the conductor.
- ❖ Joule burn is usually seen on the exposed part of the body, especially on the palmar aspects of the hand.

2. Exit marks

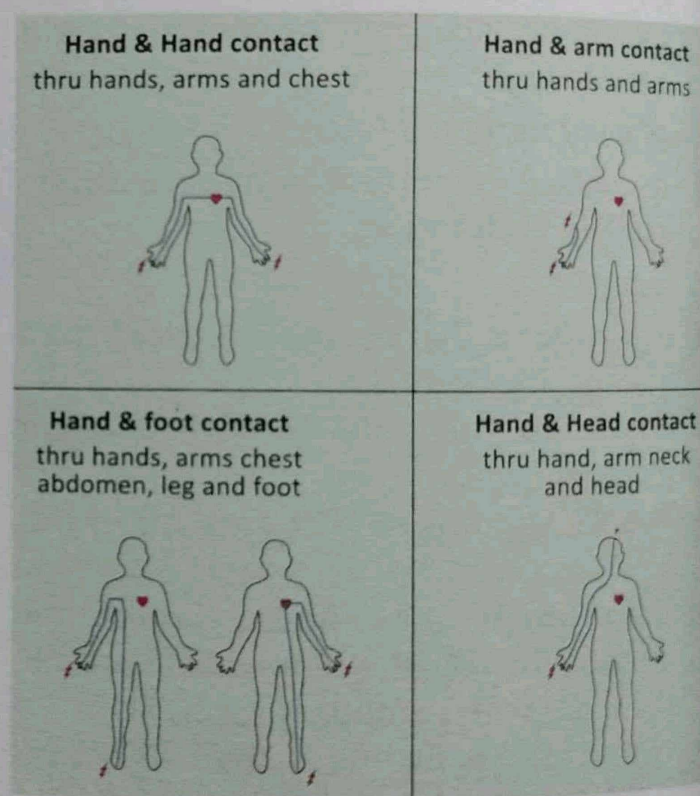


Fig: Exit wound electrocution

- ❖ In addition of endogenous burns (joule's burns) at the site of entry, there may be a wound of exit of the current.
- ❖ They are variable in size and sometimes there will be **splitting of skin** with **raised margins**.
- ❖ If the person is wearing shoes and current is of high voltage, shoes may be torn and the sole of foot may have **lacerations**.
- ❖ There is **more damage** to the wound of exit.

3. Metallization: When the current passes from a metal conductor into the body, the metal is volatilised and the particles of the metal are embedded in the skin (**electrical metallization**).

4. Exogenous burns :



- ❖ **Spark burns:** This is due to poor contact with a live electrical appliance or there is an air gap between the skin and the conductor or resistance of the dry skin.
- ❖ **Flash burns:** When a very high voltage current (high tension wire) creates a very high temperature near the skin and the superficial keratin of the skin melts over

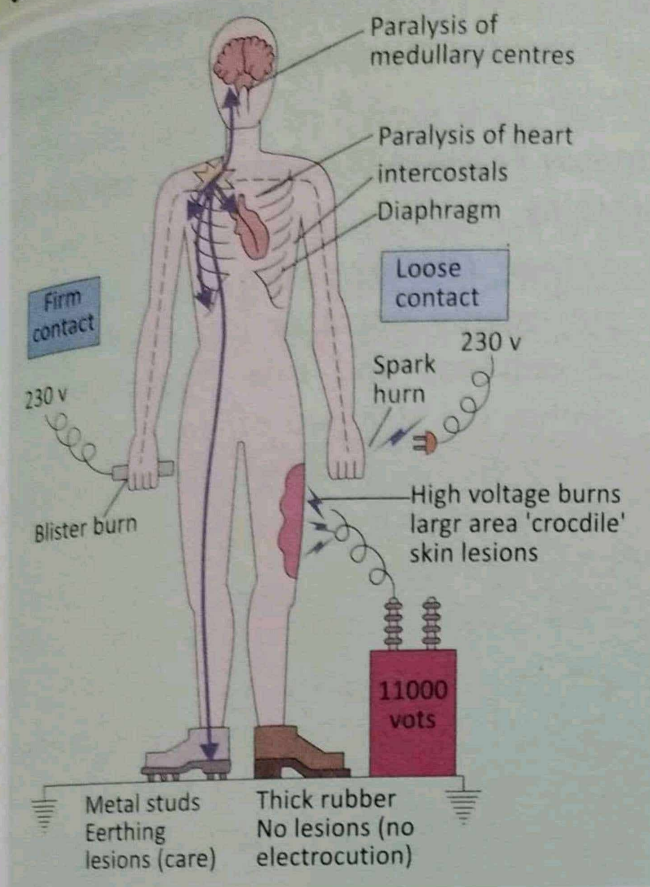


Fig: Essential features of electrocution

multiple areas to form multiple, hard, brownish nodules in the body resembles the skin of crocodile. Crocodile skin,



Fig: Crocodile flash burn

5. Bone pearls or wax drippings in x-ray

MLA

1. Manner of death most commonly is accidental
2. Suspended animation is seen in most cases. CPR is important in such cases.
3. Judicial electrocution (electric chair) is legal execution method in many countries.

4. Repeated Electric shock in a pregnant woman at work place may cause abortion. She can claim for compensation.
5. During electro convulsive therapy (ECT) person may get fracture. In such cases patient can claim for negligence against doctor.

Judicial Electrocution

This was a method of legal execution commonly used in U.S. in which the individual is securely strapped to a specifically designed wooden chair, and electrocuted through strategically positioned electrodes affixed to head and leg. It causes ventricular fibrillation and cardiac arrest.



The actual protocol and voltage varies from place to place. The scalp and left calf of the condemned person are shaved. One hour before the execution sponges soaked in brine are applied to these areas to enhance the conductivity of the skin. Metal electrodes are connected to the scalp and leg of the person and a current of 2400V (7.5A) is applied for 7 seconds. Followed by 600 volts for 17 seconds. The process repeated once. After 5 minutes the physician confirms death.

Otherwise, the procedure is repeated till the person dies.

Lightning

- ❖ It is the discharge of electricity between cloud.
- ❖ When the electricity strikes the ground it is called lightning strike.
- ❖ The lightning may hit a person directly or it may hit the victim after jumping from other object.
- ❖ The duration of lightning strike is very short (few milliseconds to seconds). The lightning strike usually gets neutralised by passing through the nearest and tallest object.
- ❖ The electrical charge of lightning strike tends to pass through the surface of a conductor, rather than passing through it; so people in the house (closed) and car are not affected.
- ❖ The lightning flashes follow the path of least resistance, so it is zig zag.
- ❖ While passing through the air, the flash of lightning releases tremendous energy in the form of heat (15,000°C-50,000°C) which causes rapid expansion of the air producing sound called 'Thunder'. Lightning differs from ordinary electric current in term of degree.
- ❖ The electric current of lightning flash is DC (10,000-20,000 ampere).

Lightning effects in Body

- ❖ It is very dangerous and not expectable.
- ❖ The current from lightning may hit the person directly or after striking an object like tree or building it splashes over to the person.
- ❖ Sometimes the lightning hits the ground and spreads to the person radially.

Death: A person hit by lightning dies due to cardiopulmonary arrest or electro-thermal injuries.

Autopsy Features In a Case of Death due to Lightning

- ❖ **Clothes:** Clothes worn by the person are usually burnt or torn at the point of entrance and exit. Sometimes the clothes get stripped off from the body, or interestingly sometimes the clothes remain intact even the person dies after hits lightning.
- ❖ Belts and boots may be ruptured

Externally

- ❖ Contusions, lacerations and other injuries like organ ruptures and burns happen due to the blast effect of expanded heated air.
- ❖ Extensive ecchymosis is seen.

Internally

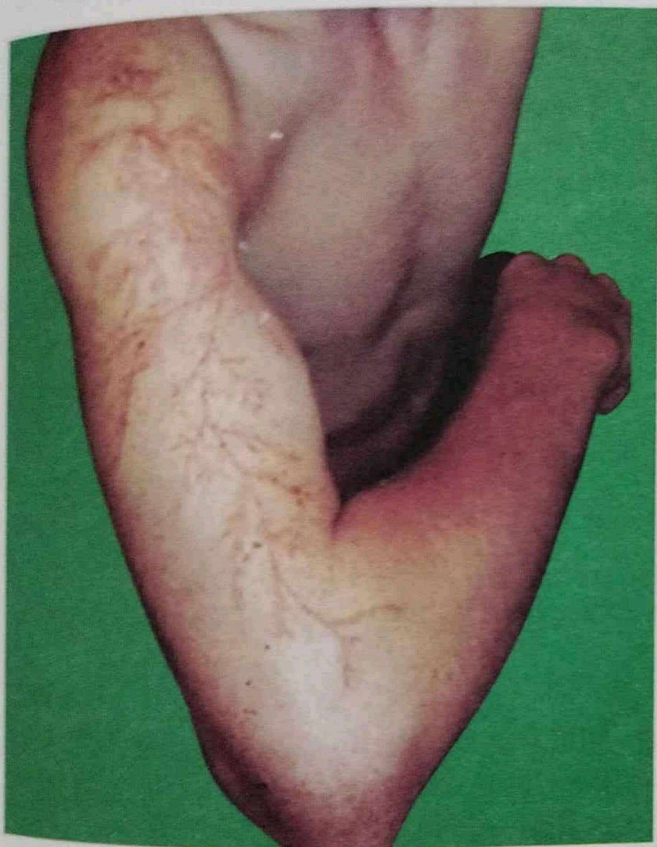
- ❖ Rigor mortis may appear soon and pass easily.
- ❖ Intense edema is seen at the point of entry.
- ❖ Signs of asphyxia are present.
- ❖ The brain is congested and edematous.
- ❖ Patechial haemorrhage is seen in the internal organs.
- ❖ Ear drum rupture and haemorrhage in the middle ear are seen.

Burns types

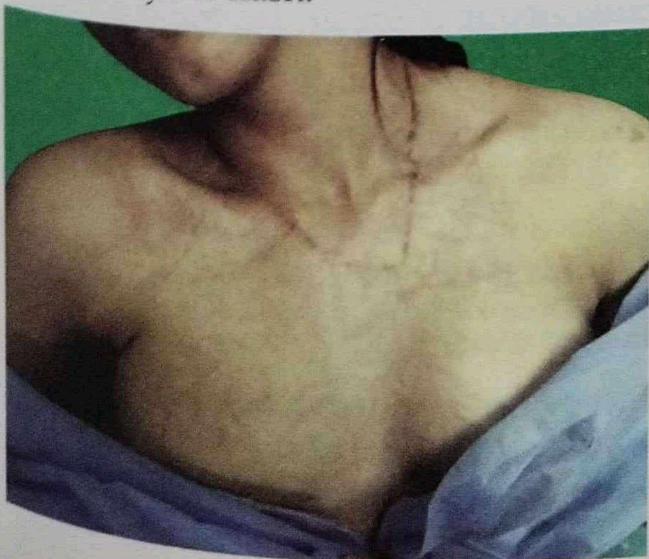
1. **Linear:** These vary from 3-30cm or more in length and 0.3-2.5cm in width. These are commonly seen in moist creases and folds of the skin.
2. **Arborescent or filigree burns (Lichenberg's flowers):** They are superficial, thin, irregular and tortuous marking on the skin. These marking have general pattern resembling the branches of a tree. The fern like pattern of redness (erythema) on the skin is usually found over the

shoulders or the flanks. It indicates the path taken by the discharge, and disappears in 1 or 2 days if the person survives. It is rarely seen.

Mechanism: Exactly not known, it may be the staining of Hb from the ruptured RBC through the path of current/electron flow.



3. **Surface burns:** They are true burns and occur beneath the metallic objects worn or carried by the person. The objects are fused by the flash.



Keraunoparalysis (lightning paralysis): It is a transient paralysis of lower limb and associated with extreme vasoconstriction and sensory disturbances of one or more extremities.

Medicolegal Importance:

- ❖ Accidental death
- ❖ The dead body is seen mostly in the open spaces and holds something which attracts lightning. Dead body found in open spaces with injuries like lacerations, contusions, etc. may lead to a doubt about homicide. So in such cases it is vital to know about the history of thunder nearby.

Radiation Injuries

- ❖ The decomposition of atoms with the emission of radioactive rays or energy (alpha, beta, gamma radiation) is called radioactivity.
- ❖ Radiation causes damage through conversion of infrared frequencies into thermal heat on absorption at the skin surface.
- ❖ Occurrence from:
 - Industrial exposure
 - Medical applications
 - Therapeutic applications

Illness

- ❖ The doses of 200-250 rads cause illness, with rising mortality is seen.
- ❖ More than 500 rads results in mortality.
- ❖ Symptoms usually start with nausea, vomiting and diarrhoea.
- ❖ Delayed effects: It may occur after years. They are malignant tumors and leukaemia, dermatitis, ulceration, infection, gangrene, depression of all elements of bone marrow, increased permeability of blood vessels, cataract, sterility, sarcoma, still birth, congenital malnutrition and mental diseases.

Legal issues:

- ❖ If it is due to medical origin, patient can claim negligence against treating doctor.

Summary**Injury**

It is the termination of natural continuity of any of the tissues of the living body

Legally: **IPC 44** says injury is any harm caused illegally to a person, to his body, mind, reputation or property

Mechanical Injury

- ❖ Abrasions
- ❖ Contusions
- ❖ Lacerations
- ❖ Incised
- ❖ Stab wound
- ❖ Fractures and dislocations

Medicolegal Classification

Depending upon the severity

- ❖ Simple injuries and grievous injuries
- ❖ Suicidal, homicidal, accidental, defense and false
- ❖ Depending upon the moment of death: ante-mortem and postmortem injuries

Abrasions

It is type of injury in which loss of superficial layers of the skin

Types

- ❖ Scratches
- ❖ Grazes
- ❖ Pressure abrasions
- ❖ Impact abrasions

Contusions

- ❖ Contusions or bruises are produced by extravasation of blood into the soft tissues, due to rupture of blood vessels caused by blunt trauma.

- ❖ Compensation to workers in occupational hazards.

- ❖ Contusion present not only externally as well as internal organs like heart, lungs or brain etc.
- ❖ Externally it may be visible as colour changes or as a slight swelling with or without abrasions over it

Types

1. Intradermal
2. Subcutaneous
3. Deep

Laceration

It is the breach of continuity of tissue involving depth more than the covering epithelium of skin or that of an organ.

Types

- ❖ **Split laceration:** it occurs by crushing skin between 2 hard objects. They are also called incised looking lacerations
- ❖ **Stretch lacerations:** overstretching of skin if it is fixed causes stretch laceration. There is localized pressure with pull which increases until tearing occurs and produces a nap of skin which is peeled off the underlying bone or deep fascia.
- ❖ **Avulsion:** it occurs when a sufficient force delivered at an acute angle to detach a portion of the traumatized surface or viscous from its attachments

Incised Wound

Incised wounds are cuts or slashes produced by the sharp edge of a weapon like knife, razor, sword etc.

- ❖ **Shape:** it is elliptical or spindle shaped

- ❖ **Length of the wound:** length is more than breadth
- ❖ **Angles:** are sharply defined
- ❖ **Margin:** well defined, cleanly cut, and sharp
- ❖ **Floor:** sharply cut and divided
- ❖ **Haemorrhage:** excessive external bleeding is seen
- ❖ **Hesitation cuts:** multiple cuts are usually seen in suicidal incised wound

Stab Wound

- ❖ Punctured or stab wound are deep wounds produced by sharp weapons
- ❖ These wounds are produced by stabbing (perpendicular force) and the depth will be more than the length of the external wound
- ❖ Stabs are usually produced by knife, dagger, sword, screw driver, arrow, spear:
- ❖ Sharp (pointed end) weapons like knife, weapon, sword etc. produces incised puncture wounds with clean external wound

Types

- ❖ Puncture wounds
- ❖ Penetrating wounds
- ❖ Perforating wounds

Firearm injuries

- ❖ **Forensic ballistics:** It is the branch of forensic medicine dealing with the investigation, of firearms, ammunition, and the problems arising from their use.
- ❖ **Firearm:** It is any weapon, which discharges a missile by the very expansive force of the gases produced by the burning of an explosive substance
- ❖ **Proximal (internal) ballistics:** It the study of firearms and projectiles.
- ❖ **Intermediate (exterior) ballistics:** It is the study of motion of projectiles after it leaves the gun barrel till the time its hits the target.

- ❖ **Terminal ballistics:** it involves the study of behavior of missiles, once they penetrate their target.
- ❖ **Wound ballistics:** it is the study of the effect of missiles on living tissue.

Thermal injuries

It is defined as tissue injury due to the application of heat in any form to the external or internal body surface.

Classification

- ❖ Dry heat-flame – burns
- ❖ Moist heat- scald
- ❖ Cold injuries
- ❖ Chemical – corrosives
- ❖ Electric injuries
- ❖ Radiation injuries

Characters of dry heat

- ❖ Dry lesion
- ❖ Does not bleed
- ❖ Hard to touch
- ❖ Very painful
- ❖ Erythema
- ❖ Coagulated and roasted patches area
- ❖ Singeing of hairs
- ❖ Burnt clothes
- ❖ Carbon material in air passages
- ❖ Vesicles not appear /small

Characters of moist heat

- ❖ Liquids/pressure steam at high temperature.
- ❖ Erythema
- ❖ Extensive vesication of large sizes
- ❖ No singeing of hairs
- ❖ Clothes wet
- ❖ No deposit of carbonated material
- ❖ Limited to skin/mouth or throat
- ❖ Skin and mucosa blister

Types of Burns

- ❖ First degree burns

- ❖ Second degree burns
- ❖ Third degree burns

Cold Injuries

- ❖ An injury caused by exposure to extreme cold that can lead to loss of body parts and even death.
- ❖ Examples are frost bite, chilblain, trench foot etc.

Hypothermia Effects of Cold

- ❖ Produced by prolonged exposure of cold.
- ❖ Cooling of the body less than 35°C
- ❖ Causes failure of temperature regulation mechanism.

Hypothermia-Local effects

Frost bite

- ❖ Exposure to dry cold.
- ❖ The exposed parts such as ears, nose, fingers and toes may show localized effects of cold.
- ❖ Necrosis of tissue.
- ❖ Temperature is usually freezing less than 0°C.

Trench foot

- ❖ Prolonged exposure of extremities to cold trenches for many hours, produces immersion foot.
- ❖ Temperature is above 0°C.

Electrical Injuries

- ❖ It may be direct or alternative current.
- ❖ AC is more dangerous than DC.
- ❖ Current 220-240volts is domestic supply, usually causes death.

Contact burn

- ❖ Due to close contact.
- ❖ Point of entry raised blister containing gas or fluid.
- ❖ Point of exit punctured or lacerated wound.

Spark burn

- ❖ Due to poor or intermittent contact.
- ❖ Dry pitted lesion surrounded by yellow parchment scab.

Flash burn

- ❖ Due to without actual contact with very high voltage more than 1000 volts.

Dowry Death

If any person demands, directly, or indirectly from the parents or other relatives or guardian of a bride or bridegroom as the case may be, any dowry he shall be punishable with imprisonment for a term which shall not be punishable with imprisonment for a term not less than 6 months but which may extend to 5 years and with fine of rupees 15,000.

Additionally gift exchanged at the time of marriage which are not considered as dowry which exempt from punishment.

Legal sections related with dowry death are S.304B, and 498A of IPC S.113A and S.113B of IEA

S.304B of IPC: defines dowry death as death of a woman within 7 years of her marriage, under suspicious circumstances :

- ❖ It is shown that soon before her death she was subjected to cruelty and harassment by her husband and his relatives for any demand of dowry.

Important Questions

MCQ

1. Legal definition of injury is by

- | | |
|-----------|-----------|
| a. IPC 44 | c. IPC 56 |
| b. IPC 54 | d. IPC 42 |

2. Attempt of throwing acid comes under

- | | |
|----------------|---------------|
| a. S. 326A IPC | c. S. 319IPC |
| b. S. 326B IPC | d. S. 324 IPC |

3. More intention is present in
 - a. Infanticide
 - b. Murder
 - c. Culpable homicide
 - d. Abetment
4. Ligature mark in hanging is an example of
 - a. Contusion
 - b. Laceration
 - c. Patterned abrasion
 - d. Incision
5. Most commonly seen abrasion
 - a. Scratch
 - b. Graze
 - c. Pressure abrasion
 - d. Patterned abrasion
6. Mastoid ecchymosis is also called as
 - a. Raccoon's eye
 - b. Panda's eye
 - c. Black eye
 - d. Battle's sign
7. Green coloured contusion is due to the formation of
 - a. Hemoglobin
 - b. Hemodsiderin
 - c. Bilirubin
 - d. Hemotoidin
8. Bridging of tissues is seen in
 - a. Abrasion
 - b. Contusion
 - c. Laceration
 - d. Incision
9. Wedge shaped wound mark in stab occurred in the weapon
 - a. Double edged
 - b. Single edged
 - c. Screw driver
 - d. Fork
10. Hide and die syndrome is seen in
 - a. Hypothermia
 - b. Hyperthermia
 - c. Stab wound
 - d. Burns

Answer key

1. a 2. b 3. b 4. c 5. b 6. d 7. d 8. c 9. b 10. a

Learning Objectives

- Define and classify injuries, medicolegal aspects of injuries.
- Describe characteristic features and medicolegal aspects of mechanical injuries.
- Describe firearm injuries, characteristic features and medicolegal aspects. Differentiate between entry wound and exit wound.
- Define and classify thermal injuries, describe characteristic features and medicolegal aspects of burns, scalds, hypothermia, effects of high environmental temperature and rule of nine.
- Explain medico-legal aspects of dowry death.

Important SAQ

- Define grievous hurt.
- Define dowry death and its medicolegal aspect.
- What is rule of nine?
- Differentiate between entry wound and exit wound in firearm injuries.
- Explain frost bite.

Important LAQ

- Explain Medicolegal importance of injuries.
- Explain mechanical injuries caused by sharp force.
- Explain the mechanical injuries caused by blunt force.
- Explain hypothermia.
- Explain hyperthermia.

Pregnancy, Delivery and Abortion

22.1 Medico-legal Aspects of Pregnancy, Delivery, Infanticide and Battered Baby Syndrome

Pregnancy

It is a physiological condition which develops in a female within her child bearing age due to fertilisation of ova by spermatozoa and embryo or foetus developing in the uterus till its birth.

Medicolegal Situation

1. **Trial in the court:** A woman may plead not to appear in the court in advanced stage of pregnancy and she may be allowed to do so.
2. **Capital punishment:** If a woman sentenced to death is pregnant, a High Court shall commute death sentence to life imprisonment.
3. **Feigning:** A woman may feign pregnancy and delivery after the death of her husband to get properties.
4. **Defamation:** Allegation of defamation can be made by an abandoned pregnant woman.
5. **Suicide/homicide:** Pregnancy may be alleged as a motive for suicide or murder of an unmarried woman or a widow.
6. **Divorce:** In a divorce case, woman may allege pregnancy to get more alimony.

7. **Criminal abortion:** Here the question of pregnancy is important in criminal abortion cases.

8. **Infanticide:** The matter of pregnancy is questioned in the cases of infanticide and concealment of pregnancy.

9. **Negligence:** A medical officer may terminate pregnancy taking it as a tumor in confusion.

10. **Maternity leave:** For getting leave benefits, a women may pretend pregnancy.

11. **Pregnancy in a minor:** It is a clear case of rape. (See the table next page)

1. Presumptive Signs of Pregnancy

These signs are having a very less value in pregnancy

1. Amenorrhoea

- ❖ This means no menstruation. It is not a reliable sign of pregnancy as it may occur in many pathological conditions like anemia, hormonal imbalance and tumor.
- ❖ There are some instances of pregnancy in woman who has never menstruated or who is supposedly menopausal.
- ❖ Menstruation may continue even after conception.

2. Morning Sickness

- ❖ It means nausea and vomiting seen usually in the morning and varies in severity.

Signs of Pregnancy

S.No	Presumptive signs	Probable signs	Positive signs
1.	Amenorrhoea	Abdominal enlargement	Foetal movements
2.	Morning sickness	Braxton Hick's sign (intermittent uterine contractions)	Foetal parts
3.	Quickening	Changes in cervix and uterus	Foetal heart sounds
4.	Hyperpigmentation	Osiander's sign	Foetal cells in the mother's blood
5.	Disturbances (sympathetic and urinary)	Test: biological test and immunological test	Placental soufflé and umbilical soufflé
6.	Fatigue	Uterine soufflé	USG
7.	Changes in the breast and vagina	Ballotement	X-ray

❖ It is more evident in primigravidae (pregnant for the first time).

❖ At the end of first trimester, it disappears.

3. Quickening:

❖ This is the feel of foetal movements (slight fluttering movements in the abdomen) by a pregnant woman for the first time, and person who first perceives this sensation is called quick with the child.

❖ It starts usually from 16-20 weeks, earlier in multi gravidae and late in primigravidae.

❖ It signifies the live foetus in uterus.

4. Hyperpigmentation

❖ This is due to increased melanocyte stimulating hormone.

❖ It is mainly seen in face and neck, axilla, abdomen and vulva.

❖ Linea nigra

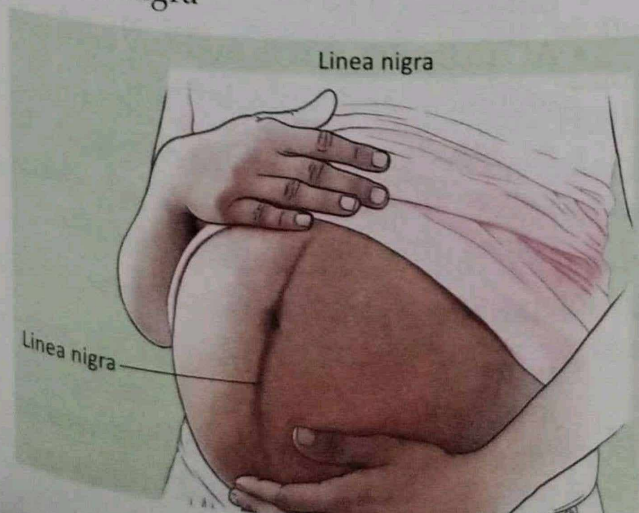


Fig: Linea nigra

• **Linea alba:** It is a permanent line of fibrous connective tissue that runs down the midline, or front of abdomen from xiphisternum to pubic symphysis.

• **Linea nigra:** During pregnancy, the linea alba darkens to form linea nigra (black line). It is a temporary dark line.

• It can be seen from 20th week of pregnancy due to the increased secretion of melanocyte stimulating hormone.

❖ **Striae gravidarum:** It is the stretch marks on abdomen during pregnancy.

5. Disturbance

❖ **Sympathetic disturbance:** Salivation, irritability and increased appetite

❖ **Urinary disturbances:** The enlarged uterus presses upon the base of bladder and results in the increased frequency of micturition. It is the earliest sign of pregnancy.

❖ **Constipation**

6. Fatigue

Seen in first trimester.

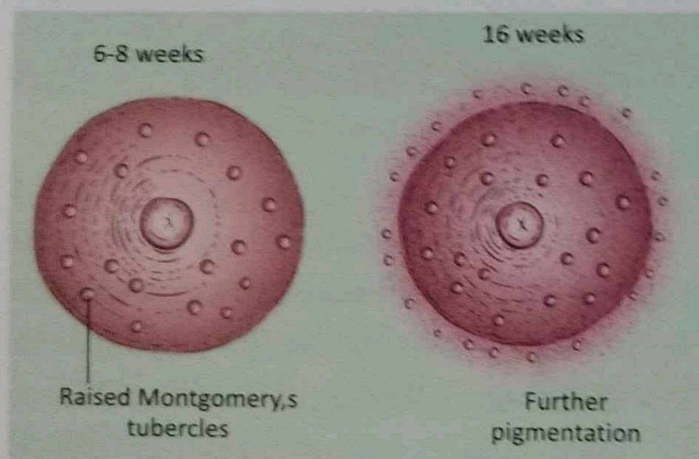
7. Changes in

❖ **Breast**

- Changes in the breast are especially important in primigravidae.
- Tenderness tingling sensation and increased size and become nodular, engorged superficial veins, nipple erect and deeply pigmented and appearance of Montgomery tubercles.

❖ **Vagina**

(jackquemier's sign or chadwick's sign)



- At fourth week of pregnancy, vaginal mucosa changes to pink to violet and finally blue due to venous obstruction.

During the first trimester of pregnancy the body undergoes significant changes to support the growth and development of the foetus. This includes increase of progesterone hormone, which helps to maintain pregnancy. The progesterone hormone has sedating effect on the body. Additionally increased demand of oxygen and nutrients for developing baby also contributes towards fatigue in the early period of pregnancy.

II. Probable Signs of Pregnancy

These signs indicate more probability of pregnancy.

1. Abdominal Enlargement

- It is due to the enlargement of uterus.
- At the end of 3 months, uterus goes below pubic symphysis.
- At the end of 4th month, uterus is located just above pubic symphysis. Uterus can be palpated by abdominal examination.
- At the end of 5th month, it is in midway between pubic symphysis and umbilicus.
- At 6th month, at the level of umbilicus, it is.
- At 7th month, it is in midway between umbilicus and xiphisternum.
- At 9th month, uterus descends to pelvis and thus the level of uterus comes down below xiphisternum.

2. Braxton Hick's sign:

- It means rhythmic, irregular but painless uterine contractions throughout pregnancy. It occurs from 16th week at intervals of 5-20 minutes, to each last-

ing for 1-5 minutes. Ultimately, it merges with painful uterine contractions.

3. Changes in

- **Cervix (Goodell's sign):** Softening of vaginal portion of cervix is seen due to increased vascularity. It is first seen at 6-8 weeks.

• Uterus:

Hegar's sign: It is the most valuable sign in early pregnancy seen at 6th week. It is a bimanual examination in which one hand is placed on abdomen behind uterus and two fingers of other hand in anterior fornix of vagina.

4. Tests

- **Biological tests:** Urine test for HCG. It is based on the detection of HCG, a glycoprotein hormone in the urine of mother. HCG is tested by syncytiotrophoblast of placenta. It first appears 7 days after fertilisation in maternal blood.

5. Immunological test

- **Uterine soufflé:** A soft blowing murmur synchronous with maternal pulse can be heard with stethoscope applied just above the midline of inguinal ligament. It is usually audible from the 16th week.

6. Ballottement (tossing of a ball)

- It is the presence of foetus in the liquor amnii. This can be visible either externally and internally. This is elicited from 4-8 months of pregnancy.
- External ballottement is elicited when placing the palms of both the hands over the abdomen, on either side of midline and pushing firmly with one hand towards the other.
- Internal ballottement is done by inserting two fingers of one hand

into the posterior fornix, and pushing sharply upwards. The fetal head will first move upwards in the liquor then settles down on to the fingers.

III. Positive Signs of Pregnancy

1. **Foetal parts and foetal movements:** Tested by bimanual palpation, this is difficult to get when the abdominal wall is fatty or in hydramnios.
2. **Foetal heart sounds:** From 20th week, foetal heart sounds are detectable by placing a stethoscope on the abdomen. The rate of fetal heart sound is 120-160/minute. It is like a muffled ticking of a watch. These can also be heard by auscultation on the abdomen by placing a foetoscope. It is difficult to hear fetal heart sounds in obese women.
3. **X-ray:** The shadow to be searched are for:
 - **Skull:** Crescentic or annular shadow
 - **Vertebra:** A series of small dots in a linear arrangement along the line of vertebral column
 - **Ribs:** A series of fine curved parallel lines
 - **Limbs:** Linear shadows
4. **Ultrasonography:**
 - **6th week:** Gestational sac and yolk sac are seen.
 - **8th week:** Foetal parts are detected.
 - **10th week:** Foetal heart beat detected.



Medicolegal Aspects of Pregnancy

A. Civil Cases

- ❖ Defamation cases can be filed When somebody claims that unmarried woman or a widow is pregnant.
- ❖ Concealed pregnancy: It occurs before marriage or after marriage by a man other than lawfully wedded spouse. It constitutes valid ground for divorce.
- ❖ Nullity of marriage: If a woman is found to be pregnant at the time of her marriage, the marriage will be declared null or void.
- ❖ Posthumous child: a child born after the death of his father is called a posthumous child : MLA : it is needed to be proved in compensation cases, inheritance of properties and legitimacy. In this cases the duration of pregnancy is checked.

B. Criminal Cases

- ❖ Pregnancy in rape cases is a positive proof of sexual act.
- ❖ Pregnancy is a cause or motive for the suicide of widow or unmarried woman. A husband may kill his wife when he suspects about her pregnancy.
- ❖ Unwanted pregnancy may lead to criminal abortion, or foeticide or infanticide.

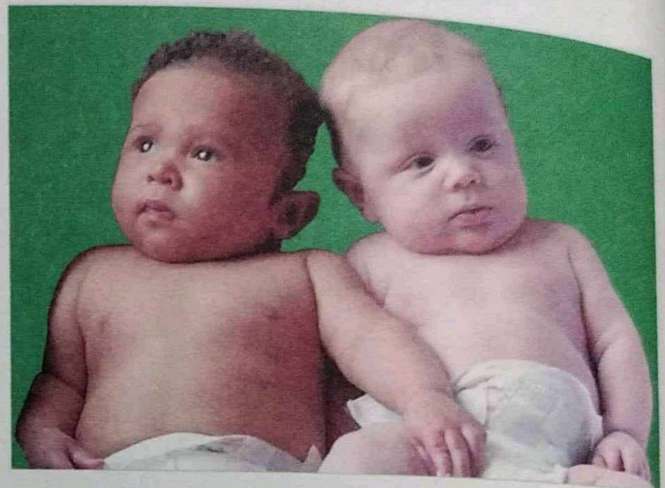
C. Civil and Criminal Cases

- ❖ **Feign pregnancy:** A woman may claim that she is pregnant despite being not to avoid execution, avoid attendance, seek leave, receive more allowance, blackmail a man and claim inheritance of property.
- ❖ **Pseudocyesis (false pregnancy, spurious pregnancy):** Although woman shows signs and symptoms of pregnancy, and she has a firm belief that she is pregnant she is not pregnant. It is usually seen in a woman especially neurotic, who strongly desires a child, is afraid of pregnancy,

is nearing menopause and is infertile
Diagnosis: Clinical examination and USC
reveal empty uterus.

❖ Superfecundation

It is the fertilisation of 2 or more ova of the same ovulatory period in two separate acts of intercourse.



- **Mono-paternal superfecundation:** When the foetuses are the result by fertilisation of ova by the same person
- **Multi paternal superfecundation:** When the foetuses are the result by fertilisation of ova by the different persons.

MLA: Multi paternal superfecundation: leads to adultery.

- ❖ **Superfoetation:** It is a rare situation. Where 2 or more pregnancies result from the fertilisation of two or more ova of the different ovulatory periods. It is fertilisation of ova in a pregnant woman.

Delivery

- ❖ It is the complete evacuation of a foetus (that has attained viability) and the products of conception from within the uterus and genital passages into the external environment.
- ❖ Delivery may be either vaginal or abdominal (ceasarean section).
- ❖ When delivery occurs after completing the term (280 days), it is called full term delivery.

- ❖ If it occurs earlier or late than the term (280 days), it is called pre-term or premature or post term/post mature respectively.

Medicolegal Aspects of Delivery

1. **Feigned delivery** (pretend delivery)
2. **Blackmail** (a woman may feign delivery and later produces a child).
3. **Chastity (defamation)**: A man may claim that his wife has delivered a child not fathered by him.
4. **Infanticide**: A woman may kill a child after delivery.
5. **Concealment of Birth**.

Signs of Delivery in Living

A doctor should get the chance to examine either a woman who claims that she has delivered a child recently or a woman for the signs of remote delivery :

1. **General appearance**: After delivery, woman feels fatigue and exhausted loss of weight, increased micturition, rise of temperature for the first 24 hours (milk fever) and after pains (tonic contractions at intervals which is more painful and severe).
2. **Breast**: Breast becomes full and prominent. The first milk which is lemon yellow in colour called colostrum can be squeezed out from breast in the first 2 days, after which mature milk is produced. Areola is dark with Montgomery's tubercles and enlarged nipples. Veins are superficially prominent.
3. **Abdomen**: Abdomen lax flabby with wrinkles for several weeks. Stretch marks are present. Silvery white linea albicantes are seen if caesarean section leaves an operation scar marks.
4. **Changes in uterus**: Because of the involution, the fundus of the uterus keeps dipping progressively after delivery:

- **Immediately after delivery**: Just above the level of umbilicus.
- **Twelve hours after delivery**: At the umbilicus.
- **After that**: The fundus descends about one finger breadth every 24 hours.
- **After the 10th day of delivery**: Uterus is not able to palpable abdominally.
- **In 5-6 weeks of post-partum**: It attains its normal non-pregnant size.

5. **External genitalia**: Labia majora is tender, swollen, bruised and lacerated and gaping.

Fourchette: It is usually lacerated in primigravidae.

6. **Cervix**: It is soft and patulous, lacerations may be present transversely :
 - **In 24 hrs**: Internal-os closes, external-os admits 2 fingers
 - **First week**: External-os admits 1 finger with tightness
 - **3rd week**: External-os closes

7. Vagina

Soon after delivery: Smooth walled, relaxed and wide :

- Rugae are ironed out and reappear from 3rd week.
 - Walls are lacerated
 - Carunculae myrtiformis: Remnants of hymen.
 - Labia majora and minora: appear, swollen, tender, gaping, bruised or lacerated.
 - **Perineum**: It shows ruptures of the fourchette, and posterior commissure.
8. **Lochia**: It is a discharge from vagina from 2-3 weeks after delivery:
 - It is alkaline and has a peculiar disagreeable fishy smell.

- It contains shredded RBCs, WBCs, vaginal epithelium, and nonpathogenic bacteria.
- The appearance from rubra---serosa --- alba
- **Lochia rubra:** bright red in colour (for the first four days).
- **Lochia serosa (5-10 days):** It appears as watery and pale.
- **Lochia alba:** After 10 days, it becomes thicker, scantier and slightly yellowish

MLI of lochia

- It is very important and indicated delivery. It appears in 2-3 weeks after delivery.
- Assessment of time since delivery can be possible.
- If it has an offensive smell, it indicates an infection.

Signs of Remote Delivery in Living

- ❖ The abdominal wall is relaxed with linea nigra and multiple scars in the abdomen.
- ❖ Breast are lax, pendulous and wrinkled.
- ❖ Areola is dark with large nipples, Montgomery's tubercle present.
- ❖ Vulva widely gaping.
- ❖ No rugae in vagina.

Signs of Delivery in Dead

The signs found in external and genital in living is present in dead also.

Apart from these other noticeable signs are:

1. **Uterus:** It may vary according to the gestations.

Duration after delivery	Weight (gms)	Dimensions (cm)
Freshly delivered	1000-2000 gms	(20x15x5)cm Lxbxh
1st week	500	14x8x4
2nd week	350	10x7x3
6 weeks	100	10x5x2

2. Placental area (site) at uterus

Duration after delivery	Dimensions (cm)
Just after delivery	10-15cm diameter and irregular, nodular and elevated and dark
2nd week	3-4cm diameter
6th week	1-2cm diameter

3. Corpus luteum

It is found in one among two ovaries. If pregnancy occurs after fertilisation, corpus luteum grows for next 5 months, after that it begins to regenerate.

4. **Peritoneum:** The peritoneum is folded and wrinkled.

5. **The broad and round ligaments are:** Relaxed, they take long time to recover the non-pregnant state.

Legitimacy

- ❖ It is the legal status of a person born in a lawful marriage.
- ❖ **Legitimate child:** A child is presumed to be legitimate if it was born during the continuance of valid marriage contract or within 280 days after dissolution of marriage by divorce or death of father, and the mother remained unmarried. (S.112 of IEA)
- ❖ The gestation period is important in this case. Normally 10 lunar months (280 days) is considered as gestation period, maximum duration has been recorded up to 350-360 days. The minimum duration of pregnancy is considered as 210 days (period of viability). Beyond the normal duration has to be checked illegitimate.
- ❖ **Illegitimate child:** Child born out of lawful wedlock or not within a competent period of time after dissolution of marriage, or if it can be proved that the alleged father is under the age of puberty, physical

incapacity to produce children, not having an access with the wife during that period, having an incompatibility of blood groups.

MLA

1. **Inheritance of properties:** Only a legitimate person can inherit the property of father.
2. **Affiliation cases:** It is the legal establishment of paternity. An order made by the first class magistrate court that a man adjudged to be the father of an illegitimate child shall contribute a specified periodic sum towards the child's maintenance. Usually the paternity cases fixed by testing blood group exclusion and DNA fingerprinting.

3. Paternity disputes

Infanticide

It is the deliberate killing of a child under the age of one.

- ❖ **Foeticide:** Deliberate killing of a foetus (8 weeks up to delivery).
- ❖ **Filicide:** Killing of a child by its own parents.
- ❖ **Embryo:** Products of conception up to 8 weeks.
- ❖ **Neonate:** Up to 28 days after delivery.
- ❖ **Neonaticide:** Killing of a neonate.

Motives for infanticide

- ❖ Illegitimacy
- ❖ Unmarried girl and widow become pregnant.
- ❖ Married woman gets conceived by other than her husband.
- ❖ Poverty of parents.
- ❖ False belief and bad omen.

Things to give special attention during autopsy

1. Child has attained viability or not (210 days).

2. Still born or dead born.
3. Live birth or not.
4. If live born, how long the baby survived.
5. The cause of death.

Still Birth

- ❖ A still birth is the birth of a child after 28 weeks of pregnancy, which does not breathe or show any other signs of life at any time after it is completely born.
- ❖ The child was alive in the uterus, and died during the process of birth or just before.
- ❖ Common causes of still birth: Intra uterine asphyxia, placental abnormalities, toxemia of pregnancy, erythroblastosis foetalis, intracranial haemorrhage and congenital defects.

Dead Born Child

The baby is already dead in the uterus and before process of birth begins and shows any of the following signs when it is born.

- ❖ Maceration
- ❖ Mummification
- ❖ Rigor mortis
- ❖ Putrefaction

1. Rigor mortis

If the baby is dead in uterus before a few hours of birth, it shows rigor mortis.

2. Maceration

It is the process of aseptic autolysis. No bacterial action occurs like putrefaction. It is seen if the baby remains the uterus after 3-4 days after death. No maceration is seen if delivery happens 12 hours after death.

❖ Signs of Maceration

1. The earliest sign of maceration is the skin slippage (seen within 12 hours after death).

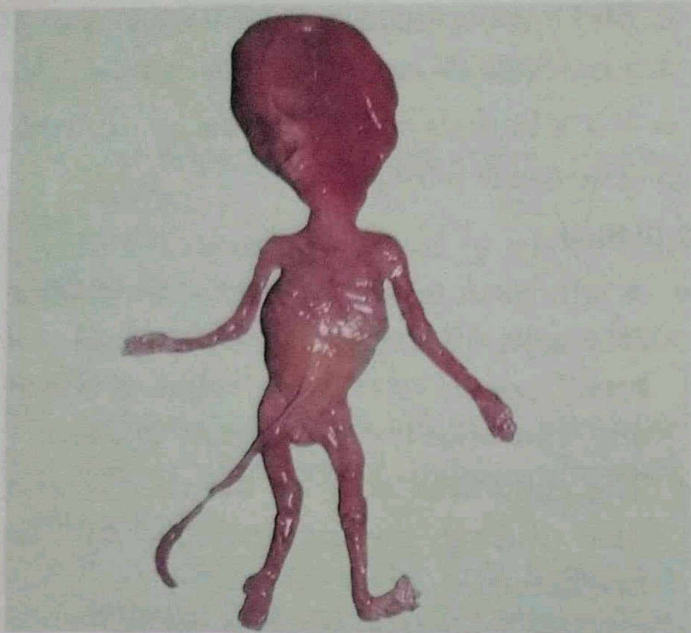


Fig: Maceration

2. The body of a macerated baby is soft flaccid flat when placed on the table.
3. It has a disagreeable odour.
4. The skin is purple in colour and contains large vesicles.
5. Distended abdomen and contains turbid fluid.
6. Umbilical cord is red and soft.
7. The joints are loose and flexible.
8. Skull bones are slides one over the other.
9. The brain is greyish and pulpy.
10. The internal organs becomes soft.

❖ **Spalding's sign**



Fig: Spalding's sign

After the death of foetus in uterus, cerebral hemispheres shrink in size. As a result, the bones of the cranial vault loosen and begin to override each other. This can be seen in x-ray. It is called Spalding's sign.

❖ **Robert's sign**

It is the appearance of gas shadow in the heart chambers and aorta on x-ray in 12 hours.

3. Mummification

It occurs when the foetus remains in the uterus for many days after the death, and amniotic fluid is very scanty. The foetus becomes dry and shriveled. It occurs after 2 weeks of death of foetus.

4. Putrefaction

If there is rupture of membrane ruptures and entry of air occurs then putrefaction sets in.

Viability of a Child

- ❖ This is the physical ability of a foetus to lead a separate existence after birth. It is called viability.
- ❖ The minimum duration required to make a foetus viable is taken as 210 days.
- ❖ But there are some instances infants surviving even with a gestation period of 180 days.

Factors helping in the assessment of viability

1. **Rule of Hasse:** It is the rough method of estimation of gestational age of the foetus after delivery.
 - If the length is less than 25cm
 - Gestational age (in months) = square root of the crown heel length of foetus in cm.
 - If the length is more than 25cm
 - Gestational age (in months) = crown heel length of foetus in cm/5.

2. Ossification centres: By the 28th week, the centre for the proximal end of the tibia, as well as the centres of cuneate, capitate, and cuboid bones appear. The centre for the proximal end of the tibia is the most reliable. Ossification centres for the manubrium appear by 5th month, and 1st to 4th pieces will appear by 6th, 7th, 8th month of IUL.

Live Birth

It means the complete expulsion of or extraction from its mother of a product of human conception, irrespective of the duration of pregnancy that after such expulsion or extraction breathes or shows any other evidences of life such as beating of the heart, pulsation of the umbilical cord or definite movement of voluntary muscles.

According to Indian law, child is considered as born alive when any part of the living child has come out of the mother's birth passage even though the child has not been completely born.

Signs of live Birth

Civil Cases

- ❖ **Crying of the baby** after its expulsion is generally accepted for civil purpose.

It is a strong evidence of live birth, but sometimes crying of foetus in the vagina (vagitus vaginalis due to inhalation of air), or inside the uterus (vagitus uterinus).

- ❖ Muscular movements
- ❖ Sneezing or yawning

In Criminal Cases

Establishment of Respiration

- ❖ **Shape of the chest:** It is flat before respiration, after which it becomes drum shaped.
- ❖ **Position of diaphragm:** The diaphragm is at the level of 6th or 7th rib, after respiration

has taken place. Otherwise it is at the level of 3rd or 4th rib.

- ❖ **Changes in the lungs**
- ❖ **The lungs are voluminous with the medial edges overlapping the mediastinum.**
- ❖ **The margins are rounded after the establishment of respiration.**
- ❖ **The consistency of the respired lungs are spongy elastic crepitant due to the distended with air.**
- ❖ **Colour:** It will be like liver that is reddish brown in case of un-respired lung. In case of respired lung, colour is red or pinkish in colour.
- ❖ **On cutting:** Frothy blood exudates from the surface on application of pressure in case of respired lungs. In case of un-respired lungs, little frothless blood extrudes on pressing the cut section.
- ❖ **Weight of the lungs:** The lungs are smaller before respiration. It consists about $1/70^{\text{th}}$ of the body weight. After respiration due to increased vascular volume it becomes $1/35^{\text{th}}$ of the body weight – this is called Ploucquet's test.
- ❖ Average weight of the fetal lung is 30-40gm before respiration. But after respiration, it is 60-70gm – foder's test.

Hydrostatic Test/Floatation Test (Raygat Test)

- ❖ The test has to be performed before giving an opinion whether the baby has respired or not.
- ❖ **Principle:** The principle is that the respired lungs are filled with air so it will float while putting in water. The un-respired lungs will sink.

Procedure

- ❖ Both the lungs are removed along with trachea, thymus and heart. Ligate the hilar portion and put it in water.
- ❖ If they float remove the heart and thymus and lungs with trachea put in water.

- ❖ If they float, remove the lungs separately and put in water. If floatation is present, cut the lungs into 15-20 pieces and put in water and test for the buoyancy.
- ❖ If the pieces float, squeeze the individual pieces between your thumb and index finger and to notice whether the air trapped will escape.
- ❖ Again put the pieces in water, if it still floats which may be due to tidal or residual air.

Conclusion

1. If all the pieces of lungs float after applying pressure on them, it indicates that respiration has been established.
2. If some of the pieces float, it indicates that partial respiration has taken place. It may be due to the fact that baby has lived for some time after birth.
3. The whole pieces of lungs sink. It indicates that respiration has not taken place.

False results

1. Respired lungs may sink due to—
 - Acute pulmonary edema
 - Pneumonia
 - Atelectasis
 - Very feeble respiration
2. Un-respired lung may float due to—
 - Presence of decomposition gas
 - Artificial respiration
 - Mouth to mouth insufflation

This test has no relevance if

3. If the child is not viable
4. The child shows intra uterine maceration
5. The decomposition occurred in foetus
6. When there is milk in stomach
7. Umbilical cicatrization has occurred
8. Monster baby – (Grossly deformed due to genetic problems)

This test has no confirmatory value but has a corroborative value.

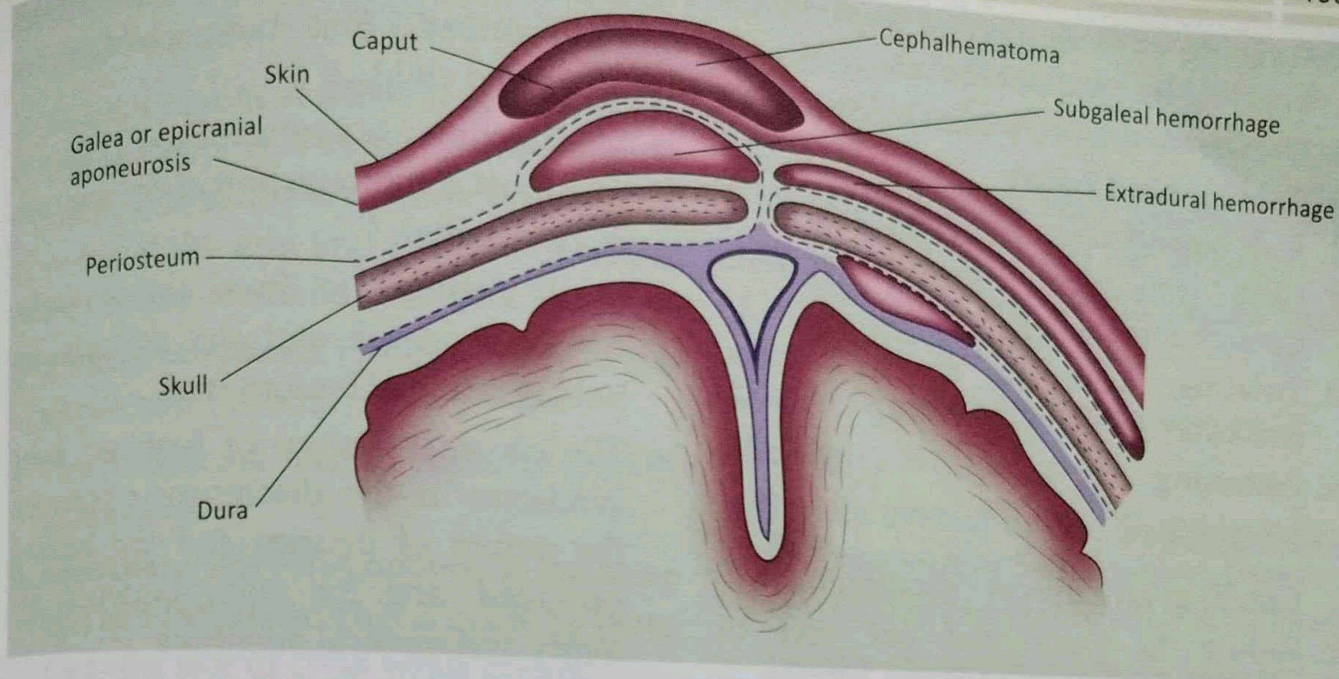
- ❖ **Stomach bowel test:** (Breslau's second life test)

When the baby breathes some air will also enter the stomach.

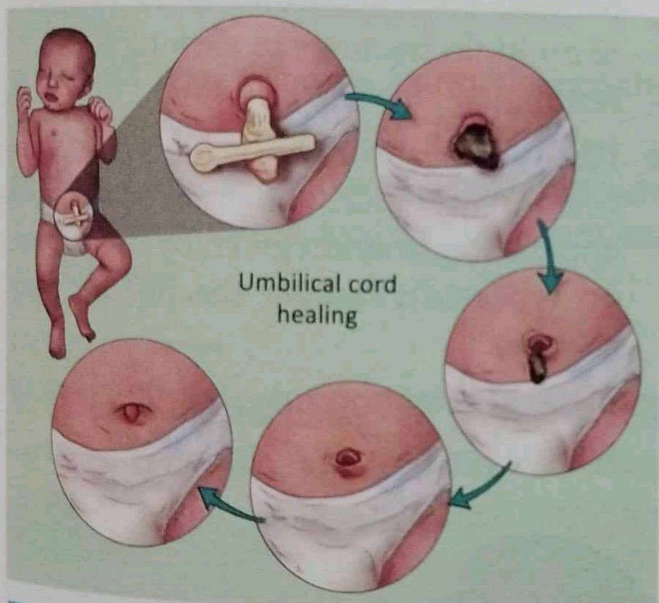
- ❖ **Wredin's test:** (Changes in the middle ear)
After birth, the gelatinous substances in the middle ear is replaced by air through Eustachian canal.

Other signs of live Birth

- ❖ **Meconium:** It is completely excreted from the bowel in the first 24 hours of birth. But in some situations like breech presentations and fetal asphyxia, meconium is excreted first.
- ❖ **Caput succedaneum:** It refers to swelling or edema of an infant's scalp that appears as a lump or bump on their head shortly after delivery. It is a localised congestion and collection of sero-sanguineous fluid in between the sub cutaneous tissue and the epicranial-aponeurosis at the presenting part of the head. This condition is harmless and is due to pressure put on the infant's head during delivery. It does not indicate damage of brain or the bones of cranium.
- ❖ **Cephalhemaoma:** It is an accumulation of blood under scalp specifically in the sub-periosteal space. This occurs by the shearing forces on the skull and scalp during the birthing process, result in the separation of the periosteum from the underlying calvarium resulting in the subsequent rupture of blood vessels.
It is seen commonly on the right parietal bone and never cross a suture line. It may not be seen outside. It increases in size in 1-2 days. After birth, it gradually subsides within 2-3 months.



Changes in the Umbilical Cord



Changes in umbilical cord	Time since birth (days)
At the cut end of the umbilical cord	2hrs
Drying up of cord	1 day
Inflammation ring appears at the base	2
Obliteration	3
Falls off	5
Scar formation	10

Circulation

Umbilical artery closes on	3rd day
Umbilical vein closes	4th day

Ductus arteriosus	10th day
Foramen ovale closes on	2-3 months

Vernix caseosa

In a full term baby, vernix caseosa is a white creamy, naturally occurring biofilm covering the skin of the foetus during the last trimester of pregnancy. It is usually seen at the axilla, inguinal regions, and buttocks part at the time of birth and it will persist 2-3 days.

Absence of vernix caseosa may indicate that the child had been washed suggesting that it survived for sometime.

Milk in Stomach

It is positive evidence of live birth and survival of baby after birth.

Criminal causes of infant death

- ❖ Acts of commission
- ❖ Acts of omission

Acts of Commission

1. **Smothering** by hands or using soft materials like towel, pillow, etc.
2. **Strangulation:** Manual strangulation, ligature strangulation by the cord itself may happen.

3. **Gagging** by cloth piece or paper piece inserting into the mouth.
4. **Drown** the baby in water (tub/bucket)
5. Causing **head injury**
6. **Stab wound** or cut throat injuries
7. **CPW** (concealed puncture wounds through fontanelle)
8. **Twisting neck** to make fracture dislocation
9. **Poisoning**

Acts of Omission

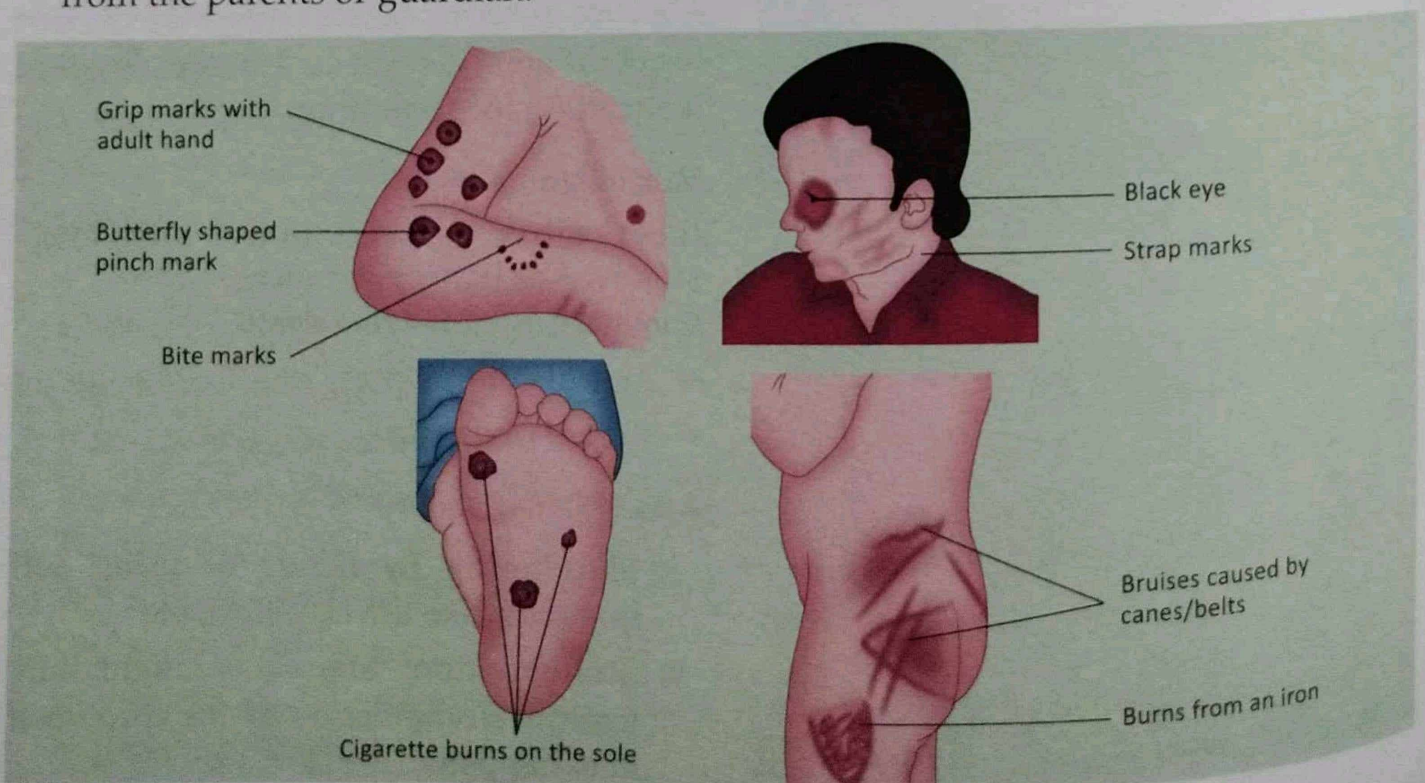
1. Failure to give proper care after birth
2. Failure to ligate the cut end of umbilical cord
3. Failure to feed
4. Failure to protect from cold or heat

Non Accidental Child Abuse

Battered Baby Syndrome

Battered baby syndrome (Caffey's syndrome)

- ❖ It describes non accidental trauma to children representing a major part of morbidity and mortality in childhood.
- ❖ The child is getting repeated physical injuries due to non-accidental violence from the parents or guardian.
- ❖ This is more evident in stepchildren, handicapped, first born children or unwanted child.
- ❖ Most victims are younger than 2 years of age (most common report of average age of 16 months).
- ❖ Most victims are from lower socio-economic status and the parents are having criminal background.
- ❖ The classical feature of battered baby syndrome is the discrepancy between the nature of injuries and the history provided, and the delay between the injury and medical attention.
- ❖ Classical radiographic presentation of battered baby syndrome is the presence of multiple fractures in various stages of healing.
- ❖ History: There may be obvious difference between the nature of injuries on the child and the explanation given by the parent, on repeatedly asking the history may changes.
- ❖ Medical attention may not be given or delayed.



Nature of Injuries

External Injuries

- ❖ **Multiple bruises of different ages:** It occurs due to slapping, kicking or throwing the child. It is called six penny bruises and noted at the arm and forearm or wrists by holding the hand.
- ❖ **Abraded contusions:** By belts, ropes, straps or pieces of woods.
- ❖ Pinch mark are seen as butterfly shaped contusions.
- ❖ **Lacerations:** It is very common in the inner lips and frenulum. This is made by blow on to the face of child while crying.
- ❖ Bald patches on scalp due to pulling of hair.
- ❖ **Burns:** Cigarette burns, buttocks burns by placing hot vessels or on hot stove.
- ❖ **Eyes:** Subconjunctival haemorrhage, retinal separation, lens displacement and black eye.

Internal Injuries

- ❖ **Subdural haematoma:** It happens due to violent shaking of head holding by shoulders. This is called infantile whiplash syndrome. No external injury is seen. Permanent brain damage occurs due to repeated habitual shaking.
- ❖ **Injuries in the internal organs:** Laceration on liver, spleen, stomach, intestines or bladder
- ❖ **Chest:** Blunt trauma to chest, rib fracture, rupture of diaphragm, and cardiac tamponade.
- ❖ There may be multiple rib fractures on the front of the chest and the x-ray shows 'string of beads' which may be mistaken for rickets.
- ❖ There may be fractures on ribs close to the spine in the posterior aspect due to

the tight holding of child in the arms, and squeezed from side to side. These are called nobbing fractures.

22.2 Abortion, Medical Termination of Pregnancy (MTP) Act, Pre-Conception and Pr-natal Diagnostic Techniques (PCPNDT) Act

Abortion = detach from the proper site

Abortion

- ❖ It is the premature expulsion of products of conception or foetus from the uterus at any time of pregnancy prior to full term.
- ❖ Legally the terms abortions, miscarriage, premature expulsion and termination of pregnancy are synonymous.
- ❖ In common language, abortion implies intentional/induced termination of pregnancy. So the term miscarriage is preferred for spontaneous foetal loss.
- ❖ In medical terms: Spontaneous expulsion of products of conception either spontaneous or induced is called as abortion.
- ❖ According to WHO, abortion is the termination of pregnancy (spontaneous or induced) before 20 weeks of gestation or with foetus born weighing less than 500gm.

Classification of Abortion

- ❖ Natural (Spontaneous) abortion.
- ❖ Artificial (induced) abortion.

Natural Abortion

- ❖ It occurs spontaneously without any induced procedure and usually coincides with the menstruation. It usually occurs in the first trimester.
- ❖ **Causes:** 1. Foetal causes 2. Maternal causes.
- ❖ Foetal causes are chromosomal abnormalities, placental diseases, defects in

placenta or embryo and low implantation of zygote.

- ❖ Maternal causes are cervico-uterine diseases, endocrine or metabolic disorders, infections, poisoning, smoking, etc.

Types of Natural abortion

1. **Complete abortion:** It is the expulsion of all the products of conception. Incomplete abortion means when some products of after the abortion conception remains in the uterus even.
2. **Threatened abortion:** In this the process abortion has started with vaginal bleeding, but the recovery is impossible.
3. **Inevitable abortion:** Heavy vaginal bleeding and pain occur in inevitable abortion. Rupture of membrane also happens and dilatation of cervix.
4. **Missed abortion:** The embryo of foetus dies inside uterus and stays there and no bleeding occurs.
5. **Recurrent abortion:** Continuous abortion
6. **Septic abortion:** Infection of uterine contents at around the time of abortion.

Artificial (induced) Abortion

1. **Therapeutic (legal or justifiable) abortion:** It is the medical termination of pregnancy or abortion performed by doctors as per the Medical Termination of Pregnancy Act (1971).

Before the establishment of this Act, women were not allowed to do legal abortion. Unmarried women, widows and rape victims had to undergo criminal abortion. It usually ended up in death of the women.

2. Criminal Abortion

It is an illegal or non-justifiable abortion.

Medical termination of Pregnancy

It is planned abortions as per MTP Act (1971, 2021)

Methods

- ❖ Usually the methods adopted in the first trimester and in second trimester.
- ❖ The methods used in the second trimester is technically more difficult, and having a higher rate of complications compared to first trimester.

Methods in the first trimester

1. Medical Method

- Medical methods: It is safe and effective. It is the best method of choice in the first trimester.
- Mifepristone (anti progestin drugs detaches placenta from uterine walls) and misoprostol (induced contractions of uterus) are the drugs commonly used (most effective up to 7 weeks of pregnancy) with success rate of 90%-95%.
- USG should confirm the period of pregnancy is less than 8 weeks and confirms that it is not ectopic.

2. Surgical methods

- Manual vacuum aspirations (MVA).
It is used to evacuate the uterus in case of incomplete abortion happened by medical method.
- Equipment:** It consists of a plastic cannula attached to 50ml plastic syringe
- Electric vacuum aspiration (or suction evacuation).
- Dilatation and curettage (D&C): Not a preferred method.

Methods Used In Second Trimester

1. **Medical methods:** Drugs such as mifepristone and misoprostol
2. Extra embryonic instillation
3. **Surgical methods:** (a) dilatation and evacuation and (b) hysterectomy

Complications of MTP

1. Death may occur due to vagal inhibition
2. **Injury:** Perforation, laceration may occur
3. Haemorrhage
4. Incomplete evacuation
5. Infections
6. Pelvic inflammatory diseases
7. Recurrent abortion

Criminal Abortion (Illegal Abortion)

- ❖ It is induced abortion and does not come under MTP Act, whether performed by qualified or unqualified persons/doctors. One who is performing criminal abortion will be punished.
- ❖ Who performs criminal abortion: unqualified persons like quacks, unregistered persons, or qualified persons like doctors outside the purview of MTP Act.
- ❖ Criminal abortions are reported when death of the woman or complications like haemorrhages or injuries happen or someone informs police.

Criminal Abortion Methods

A. General Violence

- ❖ Severe pressure over abdomen: Due to kicks, blows, jumping and kneeling.
- ❖ Violent exercises such as riding, cycling, jumping, lifting, heavy weights and driving on uneven roads.
- ❖ **Cupping:** It is a method of criminal abortion used in advanced pregnancy. A lighted wick is placed over the hypogastrium and a cup is converted over it. This creates a negative pressure and when the cup is pulled suddenly, partial separation of placenta can occur very hot and cold bath alternatively.
- ❖ Massaging the uterus through the abdominal wall.

B. Local Violence

- ❖ **Abortion stick:** It is a thin wood or bamboo stick 12-18cm long. It's one end is wrapped with gauze or cotton wool. It is then dipped in an irritant solution of marking nut juice, or calotropis, or the paste of some metallic salt. Then the stick is inserted into the cervix or vagina. It causes ulceration and bleeding from the cervical os (opening). Death of the women take place due to systemic absorption or septicemia. The application of potassium permanganate crystals can be extremely dangerous causing haemorrhage and ulceration.
- ❖ **Slippery ELM:** Its bark is used to dilate the cervix by local unskilled people. The bark is inserted into the cervix and absorbs moisture and vaginal secretions and swells up and dilate the cervix and causes abortion.
- ❖ **Metallic Paste:** Paste of potassium iodide, iodine and thymol is injected into the uterus which irritates and causes ulceration and bleeding.
- ❖ **Air insufflation:** It is conducted through the vagina by pumps.
- ❖ **Syringing:** The process of injecting a fluid under pressure is called syringing. At times, instillation of hot water has resulted in death by vagal inhibition or by embolism. Remnants of fluid and syringe can be seen at the scene of crime on visit.
- ❖ **Rupturing the membrane:** An instrument is introduced into the uterine cavity causes the membrane rupture. Amniotic fluid comes out and induces abortion.

C. Abortifacient Drugs

Ecboolics and Emmenagogues

- ❖ **Ecboolics:** These are abortifacient drugs which stimulate the uterine contraction, leading to abortion.

- ❖ **Examples:** Ergot preparations, lead oleate preparations and pituitary extract.
- ❖ **Emmenagogues:** These are also abortifacient drugs which promote uterine congestion and bleeding.
- ❖ **Borax, oil of savin, rue, laburnum and sanguinarine**
- ❖ **Other abortifacient drugs are:**
- ❖ **Genito-urinary tract irritants** such as cantharides and turpentine oil cause inflammatory tract irritation and causes the expulsion of products of conception.
- ❖ **Gastro intestinal tract irritants** such as tartar emetics which can also cause reflex contractions of uterine muscles.
- ❖ **Plant irritants:** These include seeds of unripe fruits, papaya and methi seeds. Calotropis are also commonly used.
- ❖ **Systemic poisons:** These include salts of arsenic, lead, copper antimony and mercury.

Complications of Criminal Abortion

Immediate Complications

1. Haemorrhage due to perforation of vessels.
2. Shock due to vagal inhibition resulted from instrumentation, inserting of objects into genital tract.
3. Fat embolism may occur while syringing with soapy liquid.
4. Air embolism occurs due to insufflation of air into the uterine cavity.

Delayed complication

1. Septicemia
2. Tetanus
3. Endo-toxic shock
4. Renal failure
5. Meningitis, hepatitis

Medical Termination of Pregnancy Act (1971, 2021)

1. Introduction

- It was passed in 1971 (amendments 2002, 2021) to liberalise the abortions in India on the basis of clearly specified guidelines.

2. Aim

- To reduce the criminal abortions and consequent morbidity and mortality.

3. Definition

- Termination of pregnancy is the procedure to end up a pregnancy by using medical or surgical matters.

4. Duration of pregnancy

- Recent amendment has increased the duration of pregnancy from 20 weeks to 24 weeks.
- So depending on the duration of pregnancy: up to 20 weeks—only one registered medical practitioner (RMP) is required to terminate the pregnancy.
- After 20 weeks-24 weeks: 2 RMP are required to terminate the pregnancy.

Except in

- ♦ Rape survivor
- ♦ Victims of incest
- ♦ Differently abled women
- ♦ Minors

Qualification of doctor

The doctors should have PG or diploma in O&G, completed at least 6 months house surgery in O &G, or the doctor should have assisted minimum 25 pregnancy termination cases, or who has an experience of not less than 1 year in O & G in a hospital.

5. Indications of MTP

- **Therapeutic:** Pregnancy can be terminated when there is a risk in

pregnant woman's life or of grave injury to the physical or mental health of a woman.

- **Eugenic:** Pregnancy of any duration can be terminated when there is risk to life of the newborn. There is no time limit.
- **Examples:** If a pregnant woman in the first trimester suffers with chicken pox, small pox, German measles, viral hepatitis etc. or she is treated with steroids, antidepressants, x-ray or radiotherapy.
- **Social:** Failure of contraceptive methods, (from husband or any partner other than husband). This period is limited to less than 20 weeks.
- **Humanitarian:** when pregnancy is caused by rape.

6. Consent of the woman

- Consent of the pregnant woman is required if the woman is more than 18 years.

If the woman is under 18 years (or mentally ill), the guardian should give the written consent.

- Consent of the husband is not required. But if a woman undergoing repeated MTP without informing husband is a valid ground for divorce.

7. **Medical board:** Approval board should contain a gynecologist, paediatrician, radiologist and any member notified by the state.

8. **Confidentiality:** The registered medical practitioner should not reveal the name and other particulars of the women who undergo MTP. He can disclose if the court asked to divulge it. He will be punished with 1 year imprisonment with or without fine if he discloses the information.

9. **Punishments:** 2-7 years under 3 conditions:

- When pregnancy is terminated by a person who is not an RMP.
- Conducted at a place which is not established and maintained by the Government for this type of procedures.
- When pregnancy is terminated by any person being owner of the place, which is not approved by Govt.

10. **Maintenance of records:** A register should be maintained in the hospital regarding the MTP conducted in the hospital:

- It should be maintained and kept for 5 yrs.
- Maintain professional secrecy.

Examination of a Woman who has undergone Criminal Abortion

- ❖ The signs of abortions are almost similar as the women undergo recent delivery.

In living: check for these signs

- ❖ **General appearance:** Tired, ill-health, GIT disturbance due to the irritant action of abortifacient.
- ❖ **Breast:** Signs of pregnancy, breast enlarged dark areola.
- ❖ **Vagina:** Relaxed, dilated, various injuries and bleeding.
- ❖ **Cervix:** Open and shows injuries.
- ❖ Uterus enlarged.

In Dead:

- ❖ **Uterus, cervix and vagina:** Multiple injuries and bloody discharges are seen.
- ❖ Uterus enlarged, wounded or perforated.
- ❖ **Presence of foreign bodies like** abortion stick are seen.
- ❖ Placenta detached.
- ❖ **Ovaries:** Corpus luteum.
- ❖ Breast enlarged
- ❖ **Other signs:** Pallor, Cyanosis, Pus.

Legal Aspects of Abortion and Infanticide

1. S.IPC 312

If miscarriage (criminal abortion) is done **with woman's** consent (or voluntarily causing miscarriage) :

- ❖ **Punishment:** 3yr +fine or both (if abortion has occurred before quickening)
- ❖ **Punishment:** 7yr +fine or both (if abortion done after quickening)

2. S.IPC 313

If miscarriage (criminal abortion) is done **without woman's** consent:

- ❖ **Punishment:** 10yr up to lifetime imprisonment and fine.

3. S.IPC 314

Death of a woman occurs during the act of abortion. The person causing abortion will be punished:

- ❖ **Punishment:** 10yr imprisonment and fine (if consent of the woman was present).
- ❖ **Punishment:** 10yr to lifetime imprisonment and fine (if consent of the woman was not present).

4. S.IPC 315

If any person does an act with an intent :

- ❖ To prevent child being born alive: Attempted foeticide.
- ❖ To cause it to die after birth: Attempted infanticide.
- ❖ **Punishment:** 10yr imprisonment + fine + both.

5. S.IPC 316

Any act (the primary aim to kill the mother) causes the death of quick unborn child amount to culpable homicide.

- ❖ **Punishment:** 10yr to lifetime imprisonment and fine.

Pre-conception and Pre-Natal Diagnostic Techniques (PCPNDT Act) (Prohibition of Sex Selection Act 1994) (Amendment In 2003, 2021)

- ❖ As per this Act, the pre-natal diagnostic techniques are used to detect the foetal abnormalities present if any.
- ❖ But due to the misuse of these techniques (used for sex determination and killing female foetus), regulation of the usage of these techniques have been introduced by the Govt.
- ❖ Aim of PCPNDT Act is to regulate the usage of pre-natal techniques and prevent female foeticide.
- ❖ For this purpose, the pre-natal diagnostic techniques and their advertisements are prohibited to determine sex of the foetus.
- ❖ This Act defines 3 terms :
 1. Pre-natal diagnostic techniques.
 2. Pre-natal diagnostic procedures.
 3. Pre-natal diagnostic tests.

Pre-natal diagnostic technique = Pre-natal diagnostic procedure + Pre-natal diagnostic tests

- ❖ PCPNDT Act defines 3 places which must be registered with appropriate authority. If any violation occurs the registration of these institutions may be cancelled.
 1. **Genetic counselling centres (GCC):** It provides genetic counselling to the patients.
 2. **Genetic clinic (GC):** It conducts pre-natal diagnostic procedures.
 3. **Genetic laboratory (GL):** Samples are received from GC for conducting analysis and pre-natal diagnostic tests.
- ❖ **Indications or pre-natal diagnostic techniques:**
 1. Genetic or metabolic disorders

2. Chromosomal abnormalities
3. Congenital abnormalities
4. Haemoglobinopathies
5. Sex linked diseases

❖ **It should be done in**

1. If age of woman is more than 35 years.
2. A pregnant woman who has undergone 2 or more recurrent abortions.
3. A pregnant woman who had undergone teratogenic agent like chemicals, radiation, toxins or infections.
4. Pregnant woman or her husband or their family member is having a history of physical deformity or mental retardation.

❖ **Consent**

- Written informed consent from the woman has to be taken.
- The doctor who conducts PCPNDT Act should never communicate to the pregnant woman or her relatives about the sex of the child by words, signs or any other manner.

Advertisement

Advertisement in any manner is prohibited, including internet, regarding the facilities of pre-natal determination of sex, available at the genetic clinic or centre.

Punishment for

- ❖ Advertisements related with sex determination of child :
 - Punishment of 3 years and fine.
- ❖ Disclosure of sex of child to the pregnant women or her relatives (by doctor) :
 - **First offence:** Punishment of 3 years and fine (Rs.10,000).
 - **Subsequent offence:** Punishment of 5 years and fine (Rs.50,000).

- The name of the doctor is removed from the register for a period of 5 years.
- ❖ Persons not obeying this PCPNDT Act and seeks for sex determination: People punished with :
 - For first offence: 3 years of imprisonment and 50,000 rupees fine.
 - Subsequent conviction: 5 years of imprisonment and fine of 1 lakh rupees.

22.3 Medicolegal Aspects of Artificial Insemination and Surrogacy

- ❖ Artificial insemination is also known as intra uterine insemination (IUI) while involves the insertion of a thin flexible catheter through the cervix to inject sperms directly into the uterus other than sexual intercourse.
- ❖ The assisted reproduction technology (regulation) Act 2021 was passed in December 2021 to regulate the functioning of assisted reproductive technology (ART) clinics and ART banks in the country.
- ❖ Semen obtained by masturbation of 1 week of abstinence (no sexual intercourse). This semen introduced into the vagina (intra vaginal AI) or cervix (intra cervical AI) or into the uterus (intra uterine AI). The most successful one is intra uterine AI.

Indication of Artificial Insemination

- ❖ When the husband is sterile.
- ❖ When the husband is impotent but fertile.
- ❖ When the husband is unable to deposit semen in vagina.
- ❖ When some diseases are likely to transfer from father to offspring.

Types

1. **Artificial insemination homologous (AIH):**
In this type, semen of woman's husband is used. When the husband is impotent

or dead (in case of harvested semen after death), artificial insemination of husband's is semen is used.

2. **Artificial insemination donor (AID):** In this type, semen of another person other than the husband is used. It is done when the husband is sterile, suffering from HIV, hepatitis, or Rh incompatibility.
3. **Pooled/artificial insemination of husband and donor (AIHD):** Here the semen is a mixture of husband's semen and donor's semen.

Precautions before AID

- ❖ The donor should be less than 40 years of age.
- ❖ He should not be related by blood to either the recipient or her husband.
- ❖ But preferably the donor should be similar to the husband physically, socially, and intellectually as possible.
- ❖ The donor should have sound physical and mental health, and should be free from hereditary, familial and sexually transmitted diseases.
- ❖ He should be potent and fertile (if married he should have at least 2 healthy children of his own).

Delhi Artificial Insemination (Human) Act 1996

- ❖ Applicable only in Delhi.
- ❖ It regulates sale, donation and supply of human semen and ovum for the purpose of artificial insemination.

Ethical Problems/Medico-legal Aspects of Artificial Insemination

- ❖ The medico legal issues of AI varies from country to country.
- ❖ Few commonly facing issues regarding artificial insemination are:
 1. Does AI donation amounts to adultery?

In India sexual intercourse has to be there to consider it as adultery. In case of AI, no sexual relationship is there.

2. Is it a valid ground for divorce in matter of adultery?

No, AI is done with the informed written consent of the either partners.

3. Does it lead to annulment of marriage (nullity of marriage)?

Again the answer is a no, due to the written informed consent.

4. Is the child born of artificial insemination is legitimate?

Here in this matter, the act strictly mentioned that the child born of AI (donor & husband) has to be adopted by the couple. Then the child is legitimate and he has all rights as a biological child.

The husband is considered as father of the child legally.

5. Is the doctor who performs AI is charged for infamous conduct or negligence?

To avoid such problems doctor should take care of the following :

- Exercise skill and care in selection of donor and in the performance of the procedure.
- Ensure that a registered nurse should be present at the time of whole procedure.
- He himself should attend and conduct the delivery of the child by the procedure he has conducted
- Maintain the records pertaining to the procedure meticulously.
- Strict confidentiality must be maintained.

Medicolegal Aspects of Surrogacy

Surrogacy Regulation Act 2021

- ❖ It is a law passed by the Indian parliament to regulate surrogacy in country.

❖ **Surrogacy** is a practice where a woman carries a pregnancy for another person, or couple who cannot conceive or carry a pregnancy to term and agrees to hand over the child to them after birth.

❖ This Act aims to protect the rights of surrogate mothers and children born through surrogacy, while preventing the commercialisation and exploitation of the practice.

❖ **Indication:** When the wife is unable to conceive or carry the child to term due to some unfavorable medical conditions.

❖ **Eligibility criteria for the couple for surrogacy:** To be eligible for surrogacy, the intending parents must be a heterosexual married couple who have been married for at least 5 years and are Indian citizens. They should also have a certificate of infertility from the Govt. hospital.

❖ **A surrogate mother** is a woman who agrees to bear a child through surrogacy from the implantation of embryo in her womb.

Eligibility criteria for the surrogate mother:

1. She must be a close relative of the couple.
2. She should be married.
3. Age of the woman must be 25-35 years.
4. She should not be a surrogate mother more than once in her life time.
5. She should not provide her own ova.
6. Medical fitness certificate of physical and psychological well being.

Types of Surrogacy

As per the Surrogacy Regulation Act traditional surrogacy and commercial surrogacy are prohibited.

Only gestational surrogacy and altruistic surrogacy is legal as per this Act

Gestational surrogacy: Ovum of the wife and sperm of the husband received and fertilised outside by IVF, resulting embryo is implanted into the surrogate's uterus and developing, giving birth to the baby. Here the husband and wife becomes biological parents. Surrogate become non biological mother (as she does not provide the ova) and becomes only the gestational mother.

- ❖ The Act permits only **altruistic surrogacy**, in which the surrogate mother receives no financial support except medical expenses and insurance coverage.
- ❖ **Registration of surrogacy clinic:** The Act mandates the registration of all surrogacy clinics with the appropriate authorities. The clinic must maintain records of all surrogacy arrangements (for 25 years) and submit them to the authorities.
- ❖ **Reproductive technology and surrogacy boards** established to regulate surrogacy in the country.
- ❖ **Written informed consent** should be obtained from the partners and surrogate mother before the procedure.
- ❖ **Protection of rights of a surrogate mother:** The Act mandates that the surrogate mother has the right to medical care and financial support during the pregnancy and insurance coverage (for a period of 36 months).
- ❖ **Protection of rights of surrogate child:** The Act deals with the child born through surrogacy. Will have the same rights as any biological child and the said child shall be entitled to all rights and privileges available to a natural child under any law.
- ❖ After birth, the child should not be abandoned by intending parents or intending woman.
- ❖ No RMP or surrogacy clinics should not conduct abortion during the period of

surrogacy, without written consent from the surrogate mother and on authorisation of the same by the appropriate authority.

- ❖ No RMP or surrogacy clinic should not do the sex selection of the baby.

Offences and Punishments

Any offence under this Act are cognizable, non-bailable and non-compoundable

- ❖ Any person, who conducts commercial surrogacy (money intended) or exploits surrogate mother or children, is punished with 10 years of imprisonment and fine of rupees 10 lakh.
- ❖ An RMP who disobeys the Act and its provisions shall be punished with a term of 5 years and fine of rupees 10 lakh, for repeated offence: suspension from the medical register.
- ❖ Any intending couple, or intending women who seek the aid of any surrogacy clinic for commercial surrogacy shall be punished with 5 years of imprisonment and fine of 5 lakh rupees.

Impotency and Sterility

Impotency

- ❖ It is the inability of a person to perform sexual intercourse.
- ❖ Generally this term is meant for *male impotency*. In female, it is called '*female sexual dysfunction*'.
- ❖ Male impotency is the persistent inability of a male to achieve or maintain penile erection sufficient for performing satisfactory sexual intercourse.

There are two components in the impotency of male :

1. **Erectile component:**– This is the problem in achieving and maintain the erection of penis. This is the common problem in male impotency.

2. **Ejaculatory component:**– This involves early or premature ejaculation, delayed or failure to ejaculate.

Sterility

- ❖ It is the inability to procreate.
- ❖ In male, it is the inability to impregnate.
- ❖ In female, it is the inability to conceive.
- ❖ Sterility is not a reason for nullity or voidity of marriage, but impotency is a reason for nullity of marriage.
- ❖ **Fertility and infertility:** Fertility means capacity to reproduce, while infertility is the failure to conceive children. Generally couples who are unable to beget children even after 1 year of unprotected sexual life are called infertile.
- ❖ **Sterilization:** It is the procedure to make the person sterile. In male, **vasectomy** (vas deference cut), **orchidectomy** (surgical castration, removing both the testis) and chemical castration (in this - no removal of testis but the administration of chemicals or anti-androgen agents to decrease the intensity and frequency of sexual drive and sexual fantasie) are methods of sterilization.

In females: Tubectomy (tubal ligation) and hysterectomy are used.

Causes of impotency and sterility in males

A. Organic causes

B. Functional causes

❖ Organic Causes

1. Anatomical abnormalities :

- **Congenital abnormalities:** Penis absent (hypo-spadiasis, epispadiasis), testis absent (cryptorchidism).
- **Local diseases** of penis (phimosis, paraphimosis, balanitis) of testis (acute orchitis, hydrocoel).

2. Neurogenic
 - Paralysis
 - Spina bifida
 - Meningomyocele
 - Multiple sclerosis
 - Parkinson's diseases
 - Alzheimer's diseases
3. Vascular:
 - Decreased arterial flow
4. Endocrinal:
 - Pituitary
 - Thyroid problems
 - Pancreas
 - Adrenal problems
5. Trauma :
 - Head injury-occipital region
 - Fracture of lumbar vertebra
 - Surgery – prostactomy
 - Fracture – penis
 - Amputation – of penis
6. Drugs – long term use
 - Alcohol, tobacco, cannabis, cocaine
7. General diseases
8. Chronic lead/arsenic poisoning
9. X-ray exposure
10. Ageing

❖ **Functional /Psychogenic**

1. Temporary impotency due to fear- guilt feel, anxiety, excessive desire, excessive masturbation and dislike of partner
2. Impotence quoadhanc: Man is impotent to a particular woman.
3. Bride-groom impotence: It is the sudden impotency developed in a newly married male in first night of marriage- before first night everything was normal.

Legal aspect

Potency test

- ❖ **Requisition** : Either from a police officer or from a magistrate
- ❖ **Case particulars**: Basic details like name, age, sex etc.
- ❖ Marks of identification
- ❖ Brief history of case
- ❖ **Clinical history**: Any other relevant diseases diabetes, BP, neurological disease, dyslipidemia, pelvic trauma and vascular disease
- ❖ **Consent**: If the person is an accused of rape cases, there is no need of taking the consent (S.CrPC53)
- ❖ **Examination**:
- ❖ **Physical examination**: Conscious or unconscious, oriented to time, place, person, cooperative, non-cooperative, height, weight etc.
- ❖ **Systemic examination**: All systems are checked for any abnormality.
- ❖ **Genital examination**:
 - Pubic hair length and distribution
 - Penis- present/absent, deformity, prepuse, glans penis, smegma.
 - Scrotum: rugosed/ varicocoele
 - Testicles: present/ absent
 - Injury present or not
- ❖ **Investigations**:
 - Biochemical – CBC (Complete Blood Count Test),
 - Blood sugar level
 - Renal function test
 - Liver function test
 - Lipid profile & thyroid profile
 - Testosterone, FSH, LH etc.
- ❖ **Nocturnal penile tumescence and rigidity (NPTR) test**: It is the test to check the number of erections during sleep. It

is normal to have normal erections 3-5 times during sleep.

- ❖ **Intra-cavernosal injections:** Usually, it is done to check the adequate blood supply to the penis. In this, direct injection of vaso dilatory medication or combination of medications are given into the corpus cavernosum to induce an involuntary erection.
- ❖ **Duplex Doppler ultrasonography:** It detects the blood flow towards the penis.

Opinion

Should write in **double negative** form—

"There is nothing to suggest that the person examined is incapable of performing sexual intercourse."

Causes of Impotency and Sterility In Females

- A. **Age:** The age before puberty and after menopause is sterile.
- B. **Congenital diseases:** Absence of vagina, imperforated hymen, turner's syndrome.
- C. **Local diseases:** Tumors of vagina, gonorrhea, bacterial infections.
- D. **General diseases:** DM/TB/cancer
- E. **Drugs:** Consumption alcohol, cocaine, cannabis, tobacco.
- F. **Chronic lead poisoning**
- G. **Exposure to x-ray leads to sterility**
- H. **Psychological impotency:** Fear of getting hurt, disgust of the act, emotional disturbance, religious dislikes, morbid dislike and hatred, sense of guilt arising from mental trauma and vaginismus (painful spasmodic contractions of vagina, during sexual intercourse).

MLA

1. Questions of impotency and sterility arises in.

❖ Civil cases

- Marriage- nullity of marriage, divorce

- Adoption
- Disputed paternity, legitimacy.
- Compensations for damages.
- Black mailing or defamation.

❖ Criminal case

- In cases of sexual offences- rape and sodomy.
- Potency test is usually done in cases when the person claims that he is impotent.

❖ Both civil and criminal cases

- Adultery

Virginity

- ❖ The term virginity refers only to females; but recently it has been found that signs of virginity test have no scientific relevance.
- ❖ Virginity refers to chastity. One who has never had sexual intercourse. When the woman has an unbroken hymen she is called a true virgin.
- ❖ Defloration refers to deprivation of virginity; rupture of hymen either in coitus or in vaginal examination.
- ❖ If the hymen of the woman remains intact even after sexual intercourse, that woman is called false virgin.

Hymen

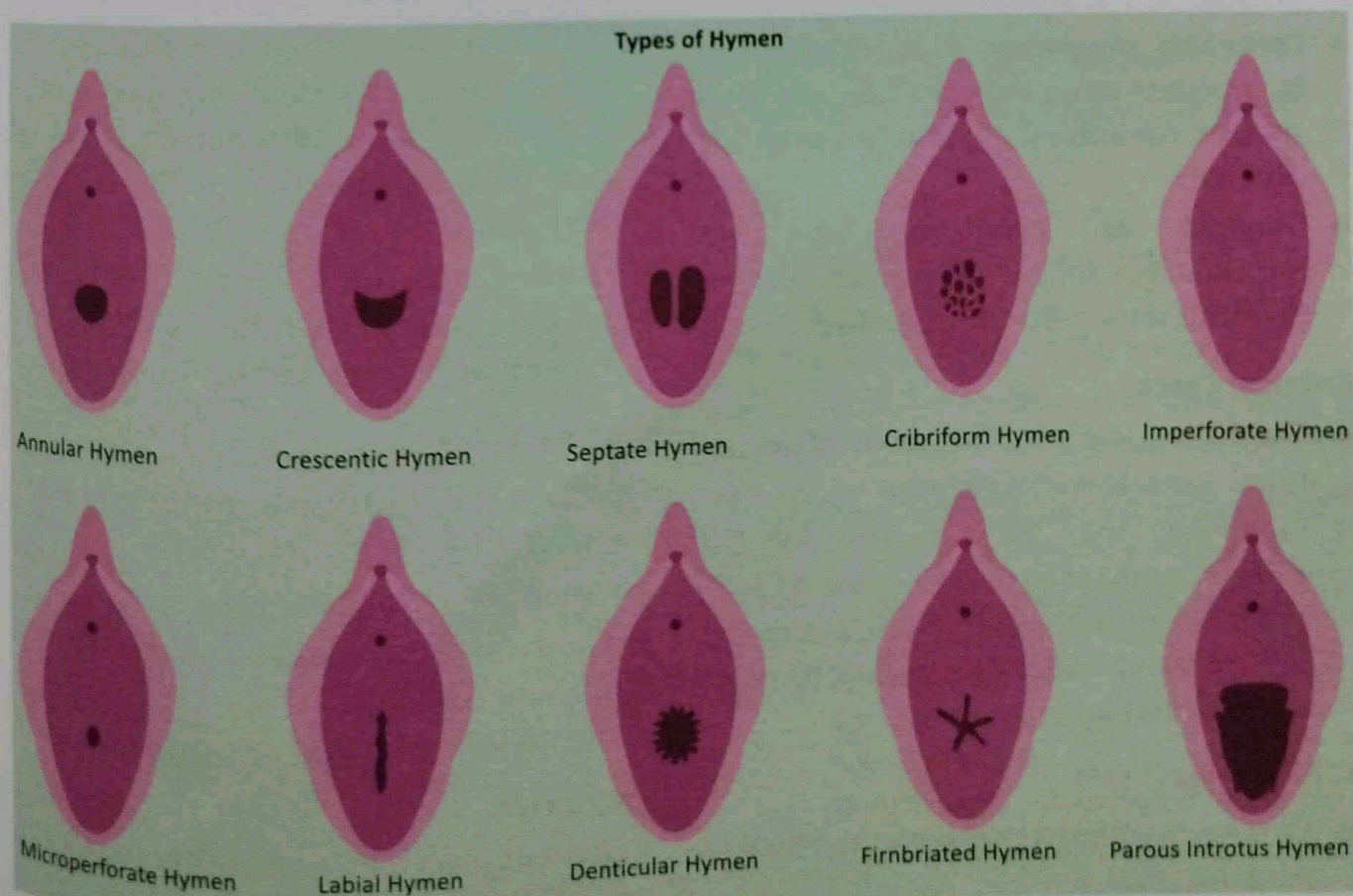
- ❖ The hymen is a thin fold of connective tissue, covered by mucus membrane of about 1mm in overall thickness and situated at the vaginal orifice.
- ❖ Commonly it is deficient anteriorly and usually has a central aperture, may be any of the following types.
 - **Annular:** The hymen forms a ring around the vaginal opening.
 - **Semilunar or crescentic:** forms a crescent shape, like a half moon above or below the vaginal opening.

- **Cribriform:** Characterised by small opening.
- **Septate:** A piece of hymen makes the septum, or bridge across the vaginal opening.
- **Subseptate:** Same as septate hymen, but does not make a bridge all the way across.
- **Fimbriate:** Makes an irregular pattern around the vaginal opening.
- **Denticular:** It looks like a set of teeth surrounding the vaginal opening.
- **Infundibulum:** Funnel shaped.
- **Labial hymen:** The opening is in the form of vertical slit in the centre, giving the appearance of vulva.
- **Imperforate:** Does not have any openings, and needs surgical corrections.
- Congenital absent hymen.

See the fig down

Causes of Hymen Rupture

1. As a result of sexual intercourse the hymen is usually torn posteriorly, with unilateral or bilateral tears extending to the point of its attachment to the vaginal wall. These bleeds when rupture and heals with a scar.
2. After the delivery of the child per vaginum, the hymen is almost completely torn leaving a small remnants called "carunculaemyrtiformes" or "carunculaehymenalis".
3. In true virgin hymen rupture occurs due to—
 - Trauma – An accidental fall on a protruding object.
 - Instrumental masturbation.
 - Careless insertion of sanitary tampons.
 - Surgical operation of imperforate hymen.
 - Per vaginal examination.



- Introduction of foreign bodies – Sola pith for making very young girls suitable for sexual intercourse.
- Ulceration occur in disease like diphtheria

- **Medico-legal view:** Even experts can't say about virginity clearly. Because of false virginity and hymenoplasty (surgical repair) and an annular hymen may looks intact even after sexual intercourse.

Summary

Medicolegal Aspects of Pregnancy

Pregnancy is a physiological condition of having a developing embryo or fetus in the body from the time of fertilization of an ovum by the sperm until the birth of the child.

ML Aspects

Civil Cases

- ❖ Malicious person may **allege either verbally or in writing**, that an unmarried woman or widow is pregnant in which case she would definitely vindicate herself.
- ❖ **Concealed pregnancy:** Before marriage by a person other than lawfully wedded spouse constitute a valid ground for divorce.
- ❖ **Duration of pregnancy:** Assumes importance when legitimacy of a prosthymous child is questioned.

Criminal Cases

- ❖ Pregnancy is a positive proof of sexual intercourse in a trial of rape.
- ❖ Pregnancy may be a motive for the suicide of a married or unmarried woman or for the murder of a married woman by her husband, when it resulted from an explicit relationship.

Civil Criminal Cases

- ❖ Women may feign pregnancy, termed as pseudocyesis.

- ❖ Superfetation and superfecundation.

Delivery

It is the complete evacuation of a fetus that has attained viability, and other products of conception from within the uterus and genital passage into the external environment.

Civil Cases

Feigned Delivery

- ❖ For claiming property of the deceased husband.
- ❖ Child in feigned delivery is called suppositious child.
- ❖ Affiliation cases: Woman claims, child's father is not her lawfully wedded spouse or husband who subsequently divorced her, then he must adopt the child as his own.
- ❖ Contested legitimacy of child: when as a part of evidence that child was born of a particular woman and her husband.

Criminal Cases

Question of delivery assumes important in the trials of–

- ❖ Abortion and infanticide.
- ❖ Concealment of child begotten out of an explicit relation.
- ❖ Affiliation case proceeding to black mail.

Infanticide

Unlawful destruction of a child under the age of one year by anyone.

Still birth

A stillborn child is one which is born after 28th week of pregnancy and which did not breathe or show any other signs of life at any time after being completely born.

Dead Born

A dead born child is one which has died in utero and shows one of the following signs after born like maceration, rigor mortis, putrefaction, adipocere, mummification.

Legal aspect:

In India it is tried under section 302IPC (murder).

Child Abuse**Battered baby syndrome**

It is the collection of injuries sustained by a child as a result of repeated mistreatment or beating.

If a child's injury indicate, intentional trauma or appear to be more severe than could reasonably could expected to result from an accident, battered baby syndrome should be suspected.

Common signs in Battered baby syndrome

- ❖ Fracture of long bones
- ❖ Subdural hematoma
- ❖ Soft tissue swelling
- ❖ Skin bruises of multiple periodicity
- ❖ Burns
- ❖ Retinal hemorrhages

Abortion

It is the premature expulsion of products of conception from the uterus at any time before the complete period of gestation.

MTP Act 1971- Amended on 2021

The new MTP act expands the access to safe and legal abortion services on therapeutic, eugenic, humanitarian and social grounds to ensure universal access to comprehensive care

See the table down

PcPNDT Act- 1994

It is enacted to stop female feticides in India and arrest the declining sex ration in India. The act banned prenatal sex determination. The act banned prenatal sex determination. It regulates the use of pre natal diagnostic techniques, like ultrasound and amniocentesis by allowing them their use only to detect:

- ❖ Genetic abnormalities
- ❖ Metabolic abnormalities
- ❖ Chromosomal abnormalities
- ❖ Certain congenital malformations
- ❖ Hemoglobinopathies
- ❖ Sex linked disorders

No laboratory or centre or clinic will conduct any test including USG for the purpose of determining the sex of the foetus.

No person including the one who is conducting the procedures as per the law,

	MTP-1971	MTP-2021
Indications	Only applies to married women	Unmarried women are also covered
Gestational age limit	20 weeks for all indications	24 weeks for rape survivors, Beyond 24 weeks for substantial fetal abnormalities
Medical practitioner opinion required before termination	One RMP till 12 weeks 2 RMP till 20 week	One RMP till 20 weeks Two RMP 20-24 weeks Medical board approval after 24 weeks
Breach of the women's confidentiality	Fine up to Rs. 1000	Fine/imprisonment of 1 year

will communicate the sex of the fetus to the pregnant woman or her relatives by words signs or any other method.

No person can put advertisement for pre natal and pre conception sex determination facilities in the form of a notice, circular label, wrapper, or any other.

Artificial Insemination

Types

1. **AIH:** (Artificial insemination by Husband- consist of collecting the husband's sperm and injecting into his wife's reproductive tract via the vagina at the appropriate stage of the menstrual period.
2. **AID:** Scientific aspects are the same as that of AIH except that the sperm donor is used instead of the husband.

Medicolegal issues -Question of-

1. Adultery
2. Affiliation cases
3. Divorce or nullity of marriage
4. Professional negligence and infamous conduct.

Surrogacy

It is an arrangement in which a woman (the surrogate) agrees to carry and give birth to a child on behalf of another person or couple. Surrogate mothers are impregnated through the use of in vitro fertilization (IVF). In this process, doctors create an embryo by fertilizing eggs from the intended mother or an egg donor with sperm from the intended father or a sperm donor.

Important Questions MCQ

1. **Goodell's sign is the**
 - a. Blue colour of vagina in pregnancy
 - b. Cervix becomes soft during pregnancy
 - c. Flat vagina after delivery
 - d. Injuries present in cervical area
2. **Fertilisation of ova at the same ovulatory period but different by different acts of coitus**
 - a. Superfecundation
 - b. Superfetation
 - c. Pseudocyesis
 - d. Suppositious child
3. **Lochia serosa is seen in**
 - a. After 10 days of delivery
 - b. Immediately after delivery
 - c. After 5-10 of delivery
 - d. During pregnancy
4. **Child born in legal wed lock is**
 - a. Suppositious child
 - b. Feigned child
 - c. Illegitimate child
 - d. Legitimate child
5. **Age of embryo is**
 - a. Less than 8 weeks
 - b. Less than 28 days
 - c. Less than 210 days
 - d. Less than 10 months
6. **The child attains viability but does not show any signs of life after being completely born from the uterus is**
 - e. Live birth
 - f. Dead born
 - g. Still birth
 - h. IUD
7. **The process of aseptic autolysis is called**
 - a. Sepsis
 - b. Putrefaction

- c. Decomposition
d. Maceration
8. Gas shadows in greater vessels in x-ray seen in infanticide is called
a. Spalding sign c. Embolism
b. Fibrillation d. Robert's sign
9. Six penny bruise is the special feature seen in
a. Infanticide b. Crib death
c. Battered baby syndrome
d. Child abandoning
10. Level of diaphragm is at --- before respiration
a. 2-3rd rib c. 6-7th rib
b. 3rd -4th rib d. 4th -6th ribs

Answer key

1. b 2. a 3. c 4. d 5. a 6. c 7. d 8. d 9. c 10. b

Learning Objectives

- Define pregnancy, delivery, infanticide and battered baby syndrome along with their medico-legal aspects.
- Define and classify abortion, MTP Act and PCPNDT Act.
- Describe surrogacy (Regulation Act 2021) and Assisted Reproductive Technology (Regulation) Act 2021.

Important SAQ

- Explain the medicolegal aspects of pregnancy.
- Explain the medicolegal aspects of delivery.
- Explain the medicolegal aspects of infanticide
- Explain battered baby syndrome.
- Explain MTP Act.
- Explain PCPNDT Act.
- Explain artificial insemination.
- Explain surrogacy and its regulation.

• • •

Sexual Offences

Sexual Offences

There are a range of crimes that can be considered as sexual offences including non-consensual crimes such as rape, sexual assault, crimes against children including child sexual abuse or grooming and crimes that exploit others for a sexual purpose whether in person or online.

Classification Sexual Offences

1. Natural sexual offences

- a. Rape
- b. Incest
- c. Adultery

2. Unnatural sexual offences

- a. Sodomy
- b. Tribalism
- c. Bestiality
- d. Buccal coitus

3. Sexual paraphilia

- a. Sadism
- b. Masochism
- c. Necrophilia
- d. Fetichism
- e. Transvestism
- f. Exhibitionism
- g. Masturbation

h. Frotteurism

i. Undinism

4. Sex linked offences

- a. Stalking
- b. Voyeurism
- c. Sexual harassment
- d. Trafficking
- e. Indecent assault

23.1 Rape

IPC section 375 defines rape

A man is said to commit rape on a woman if he does the following Act:

- ❖ **Penetrates his penis** to any extent into the urethra, vagina, anus and mouth (UVAM) or makes her to do so with him or any other person.
- ❖ **Inserts any other object or part of his body**, not being the penis, into the vagina, urethra or anus of a woman or makes her to do so with him or any other person.
- ❖ **Manipulates** any part of the body of the woman so as to cause penetration into the urethra, vagina, anus or any part of a body, or makes her to do so with him or any other person.
- ❖ **Applies his mouth** into vagina, urethra or anus of a woman or makes her to do so

with him or any other person under the circumstances falling under any of the following 7 situations :

1. Against her will
2. Without her consent
3. With consent, when such consent obtained by fear of death or hurt.
4. With her consent when the man knows that he is not the husband and the consent was given because she believes that he is another man to who she lawfully married.
5. With her consent when at the time of giving such consent, by the reason of unsoundness of mind or intoxication or administration by him personally or through another of any stupefying or unwholesome substance, she is unable to understand the nature and consequences of that to which she gives consent.
6. With or without her consent when she is under 18 years of age, this is known as statutory rape.
7. When she is unable to communicate consent e.g. when a male performs sexual intercourse with an unconscious woman, amounts to rape.

Explanation 1: Penetration to any extent is penetration to this purpose.

Explanation 2: For the purpose of penetration vagina is considered as labia majora.

Explanation 3: Consent means the voluntary agreement, when the person by words, gesture or any form of nonverbal communications communicates willingness to participate in the specific act.

Absence of physical resistance shall not be the only reason which can be regarded as consenting to sexual activity.

Exception: A medical procedure or intervention shall not constitute rape.

Exception: Sexual intercourse with one's own wife is not rape as she is more than 15 years. (Supreme Court increased the age to 18)

Will Vs Consent

- ❖ There is a chance to get confused with the terms will and consent.
- ❖ But the two terms are different, will is the desire, wish or the choice.
- ❖ Consent is the compliance or the approval of what is done, or proposed by other.
- ❖ It is important that legally valid consent (whether implied or expressed) must be given before the act, if it obtained subsequent to the act is not acceptable.
- ❖ Consent obtained by force, fear and fraud is not legal.

Some situations:

1. **Will present consent absent:** If a boyfriend (major) ask, his girlfriend (minor) to have sex. Girl is interested (will) and gives her consent. Her consent is legally not valid if she is less than 18 years.
2. **Will absent consent present:** A person threatens a woman to kill her family, and it will not happen if she is ready for sex with him. She consents. Here will is absent and consent present but due to fear.
3. **Both will and consent present:** Sex Act between a boyfriend and girlfriend, if both are major. They have will and their consent is legally valid.
4. **Both will and consent are absent:** Sex act in rape, or sex act done with force has no will and consent.

Punishment For Rape

S.376, S.376A - S.376E

S. 376 IPC: It defines punishment for rape as per Criminal Amendment Act 2018 in three clauses:

1. Whoever (in the following sections) shall be punished with 10 years imprisonment to life time imprisonment with fine (a stranger man meets a woman for the first time and commits rape).
2. Whoever commits rape in following situations the punishment shall be 10 years imprisonment to life time imprisonment with fine :
 - a. If a police officer commits rape, within the limits of his jurisdiction, or in the premises of any police station or on a woman in his custody.
 - b. If a public servant takes advantage of his official position and commits rape on a woman under his custody.
 - c. If any member of armed force commits rape.
 - d. If the staff member in jail or remand home or institution for children and women commits rape in such places.
 - e. If a staff of a hospital commits rape in the hospital.
 - f. If relative, guardian, or teacher commits rape.
 - g. Rape during communal or sectarian violence.
 - h. Rape on a pregnant woman knowing her to be pregnant.
 - i. Rape of a woman who is incapable of giving consent.
 - j. If any person in a position of control, or dominance over a woman commits rape on such woman.
 - k. Rape on a woman incapable of giving consent.
 - l. Rape on a woman with mental and physical disability.
 - m. If any person while committing rape, causes grievous bodily harm, disfigures, or endangers life.
 - n. If any person rapes a woman repeatedly.

3. Whoever commits rape on a woman of less than 16 years of age shall be punished with imprisonment of 20 years to life imprisonment.

S.IPC 376A: Punishment for causing death or persistent vegetative stage (coma) of a woman while committing rape is 20 years to life imprisonment and fine.

S.IPC 376AB: Punishment for committing rape on a woman less than 12 years is 20 years to life imprisonment with fine.

S.IPC 376B: Punishment for sexual intercourse by a husband with his wife during separation is 2-7 years and fine.

S.IPC 376C: a public servant, or a person in authority or superintendent of jail, remand homes, women children institution, hospital staff is punished with imprisonment of 5-10 years is commits rape on a woman under his custody or under his charge.

S.IPC 376D: Gang rape, when more than one person acting in with a common intention rape on a woman each one shall be believed to have committed rape punishment is 20 years to life imprisonment and fine.

S.IPC 376DA: Gang rape of a woman less than 16 years of age (punishment lifetime imprisonment and fine).

S.IPC 376DB: Gang rape of a woman less than 12 years of age (punishment life time imprisonment or death).

S.IPC 376E: Repeat offenders of rape gets punishment of lifetime imprisonment or death.

Duties of A Doctor in A Case of Rape

A doctor attending a case of examination in rape have 3 duties :

1. **Ethical/Moral:** Since the victim has suffered to a mental and physical trauma, she may not be able to communicate and give the details properly, so the doctor should establish a rapport with the patient/victim, the doctor should

be empathetic, reassure her, talk to her mildly in a simple understandable language.

Treat her with respect and dignity

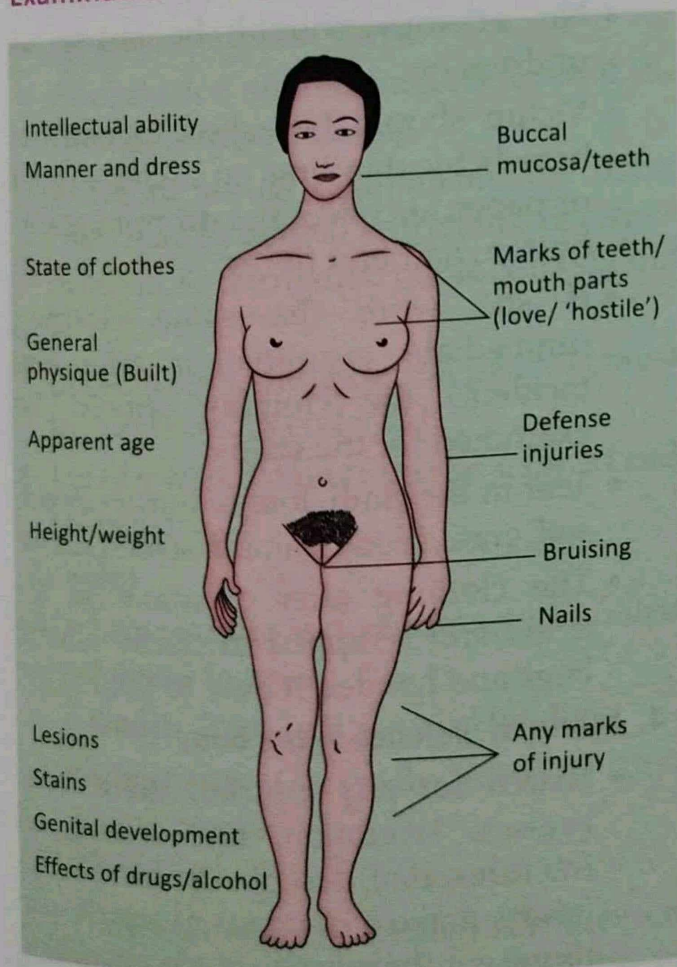
Ensure confidentiality.

2. Medical duties: Give proper treatment in time, check vitals, ABC measures, take steps to prevent pregnancy, prophylaxis treatment and follow up should be done.

3. Legal duties:

- Inform police
- Prepare medicolegal case
- Collect and preserve the evidences
- Age estimation
- Opinion provisional and final

Examination of Rape Victim/Alleged Survivor



corroborates with the history, to collect the trace evidence, to treat injury, to prevent STD, to prevent pregnancy and to manage psychological damage.

3. Examination done by: If the survivor is a child, she must be examined by a female doctor (POCSO Act), if the victim is above 18 years, then she should be examined preferably by a female doctor, if female doctor is not available then a male doctor can examine the victim in presence of a registered female nurse.

4. Do not delay the examination as it may lose the evidentiary value.

5. Separate the survivor from the accused and keep separately during examination. The survivor should be examined first to provide the treatment.

Procedure

❖ Regarding the medicolegal examination of a survivor should come either from a magistrate or a police officer above the rank of sub-inspector. He should identify the victim.

General Particulars

- ❖ Name/age/sex/residence/occupation/marital status, height/weight (sex has to be mentioned because a person of any sex can commit a sexual assault crimes).
- ❖ Date and time of incident, receiving as well as examination, place of examination, thumb impression of both right as well as left thumb should be taken.

History

- ❖ Brief history of the incident
- ❖ Date and time of place of the offence, number and names of criminals.
- ❖ Physical violence and about the weapon used, type of violence (beating, biting, kicking abdomen, pulling the hair etc.),

1. Examination should be conducted as per S.164A of CrPC

2. Objectives of medicolegal examination:
To search for physical signs which

loss of consciousness, struggle, resistance, bleeding present or not, the person was under the influence of any drugs or alcohols, administered any drugs or alcohol.

- ❖ **About the sexual violence:** Use of condoms or lubricants, pain in the genital during or after the incident, penetration of penis into urethra, vagina, or anus, insertion of finger or any other objects, masturbation by assailant, sucking, licking, kicking or spitting by the accused.
- ❖ Threatening
- ❖ History of last consensual intercourse happened if any (date and time) because to know that the presence of sperm in the genital tract.
- ❖ Whether the woman had done bathing or change of cloth, vaginal wash or change of tampons or sanitary napkin or something.
- ❖ Menstrual history: whether she was menstruating at the time of incident or during examination and date of LMP.
- ❖ Past history of any sexual abuse.
- ❖ Any diseases or if she is under any medication.

Consent

- ❖ Informed consent should be obtained from the victim for the examination.
- ❖ If the victim has approached an RMP for medical examination, the doctor can examine and prepare medicolegal report as per her request. No requisition from the authority is required. But the doctor is bound to inform the police about the incident if she refuses also.
- ❖ **Age:** If the woman is less than 12 years and mentally unsound the guardian should give the written informed consent. If the woman is above the age of 18 years she

herself can give consent for examination. In all cases, a disinterested person like staff nurse should be a witness.

- ❖ Consent is given for medical examination, sample or collection of evidence, treatment and information to the police.
- ❖ A doctor can start treatment if the victim is in danger without consent (S.IPC 92).

General Physical Examination

1. Identification marks

2. Systemic examination

- Mental status – conscious or not
- Vitals – HR, BP, RR, temperature etc.
- Abdomen
- Gait

3. Clothes

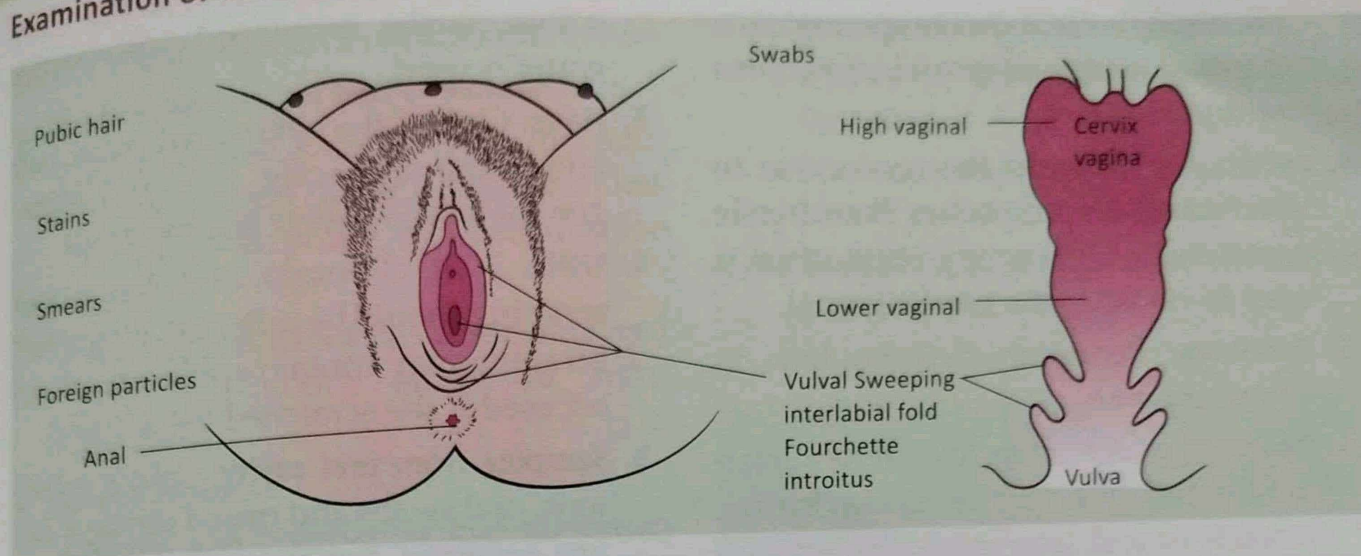
- No attempt should be made to undress her.
- Victim should be asked to undress herself by standing on a clean sheet of paper to collect the droppings e.g. button, hair and fibres.
- If she wore the same clothing (immediate examination after the incident) the clothing should be examined for the stains.
- Tear in the cloth, loss of button, mud, soil, grass, blood stains or semen stains.
- The clothing after examination air dried and wrapped in sterile plastic bags and handed it over to the FSL.

4. Marks of violence in the body

- Search for any injuries, (abrasions, bruises, laceration, bite marks, or fractures, etc.), describe the location of injury, make a diagram of injuries or represent the injuries in a body chart.

5. Mouth

- Oral cavity should be examined for any bleeding, discharge, tear oedema tenderness etc.



- ❖ The examination of genitals should be done in good lighted room and the patient in lithotomy position.
- ❖ Examination should be conducted in a most sympathetic way.
- ❖ Examination should be done even if the woman is menstruating.
- ❖ In recent sexual relationship the pubic hairs may be matted with stains of semen or blood, so the matted pubic hairs should be collected.
- ❖ Loose hairs at the external genitals must be combed and collected.
- ❖ Dried seminal stains must be scraped and collected.

1. Vulva

- Labia majora and minora are examined for any injuries.
- **Clitoris:** Red, swollen and tender.
- **Fourchette:** Generally torn at first intercourse.

2. Hymen

- The status of the hymen is irrelevant because its tearing may happen due to several other reasons such as riding, masturbation. An intact hymen does not rule out sexual violence. So only the injuries relevant to the sexual assault

fresh tears, bleeding, tenderness, oedema etc. have to be noted.

3. Vagina

- Examine with a sterile speculum lubricated with warm saline or sterile water.
- Per vaginal examination (P/V) can be done if the victim is an adult and medically indicated.
- In cases of minor, if no penetration or no visible injury is present, PV examination is avoided.
- Gentle retraction is allowed to visualise the vaginal canal and note for any redness injuries, abrasions, lacerations, contusions etc.
- To look very small injuries magnifying lens or colposcope should be used and spray 1% of toluidine blue dye for better visualisation.
- Two finger insertion test is now not usually done as the size of vaginal introitus has no bearing due to sexual violence.
- Collect the samples by vaginal swabs - blood stains, semen stains, and bleedings. Vaginal washing's also collected.

- Vaginal secretions should be examined microscopically. If motile spermatozoa is present indicates sexual intercourse within 12 hours.
- 4. **Cervix:** Abrasions in the cervix due to insertion of fingers rather than penile penetration. Colposcopy microscope is used to visualize the cervical canal.
- 5. **Perineum:** Perineum may be torn in young children.
- 6. **Anorectal examination:** It includes external examination (e.g. abrasion, bruise, laceration) and internal examination of tear, bleeding swelling, discharge etc. should be noted.
- 7. **Inner thigh:** Bruising of inner thigh may be created by the attempts to pull apart the legs.

Collection and Preservation of Samples

- ❖ Evidence must be collected as early as possible and it is better to collect evidences up to 96 hours (4 days) by using SAFE kit.

❖ SAFE Kit

SAFE: (Sexual Assault Forensic Evidence) kit or physical evidence recovery Kit (PERK).

This kit contains necessary instructions and authorisation forms, sheets, envelopes, bags, glass, slides, anal and rectal swabs, vials and bottles, anatomical drawings, charts and labels. The kit is designed for collection and preservation of trace evidence in case of sexual assaults.

Samples To be Collected

1. **Clothing:** Examine the cloths which she was wearing at the time of incident. The cloths should be air dried and preserved.
2. **Swabs:** To collect various types of stains on the skin. (Example: Saliva, semen, blood). For moist skin, dry swabs are

- used and for dry stains in the skin, cotton swabs moistened with sterile water is used.
3. **Hairs:** Collect the cut matted pubic hair and comb the scalp hair and extra-genital hair to collect any materials.
 4. **Nails:** Nail clippings and finger nail scraping should be collected. Finger nail scraping may contain epithelial cells of accused if she scratched the accused.
 5. **Samples from oral cavity:** Saliva secretions, oral swabs and rinsed sterile water are collected for analysis of DNA or spermatozoa.
 6. **Urine sample:** Urine is collected test for drugs, for example alcohol, sleeping pills.
 7. **Blood sample:** blood is collected in 3 vacutainers for blood groupings and for matching blood stains.
 8. **Genital evidences:**
 - Vaginal smears have to be prepared on the glass slides, air dried, in the shades to avoid degradation (decomposition) of the sample.
 - Vaginal washings: Take 2mL of distilled water in a syringe, attach a small rubber catheter, instill water into the posterior fornix because spermatozoa are best removed from posterior fornix and send this fluid to FSL for analysis of spermatozoa and also for DNA analysis.
 9. **Provisional opinion:** If there evidence of recent forceful penetration of vagina, opinion regarding sexual intercourse will be given after getting the report of FSL.
 10. **Final opinion:** If there is evidence recent forceful peno-vaginal intercourse (as FSL result shows positive spermatozoa).
 11. The doctor must hand over the report to the investigation officer.

Examination of Accused of Rape

S.53A CrPC deals with examination of rape.

❖ Things to remember before examination

- If the accused is not arrested, (brought by the general public), the doctor has to inform the police and label the case as MLC.
- A written consent has to be obtained from the police officer or from the court.

❖ General features

- Name, age, occupation, marital status, identification status, date, time, and place of examination.

❖ Consent

- If the accused is not arrested, inform police and get him arrested. Then as per the requisition of police (CrPC 53A), a medical officer can examine the accused.
- If the accused is already arrested by the police, the doctor can examine the patient accused of rape without consent under S.53A of CrPC and a reasonable force can be applied to examine him.

❖ History

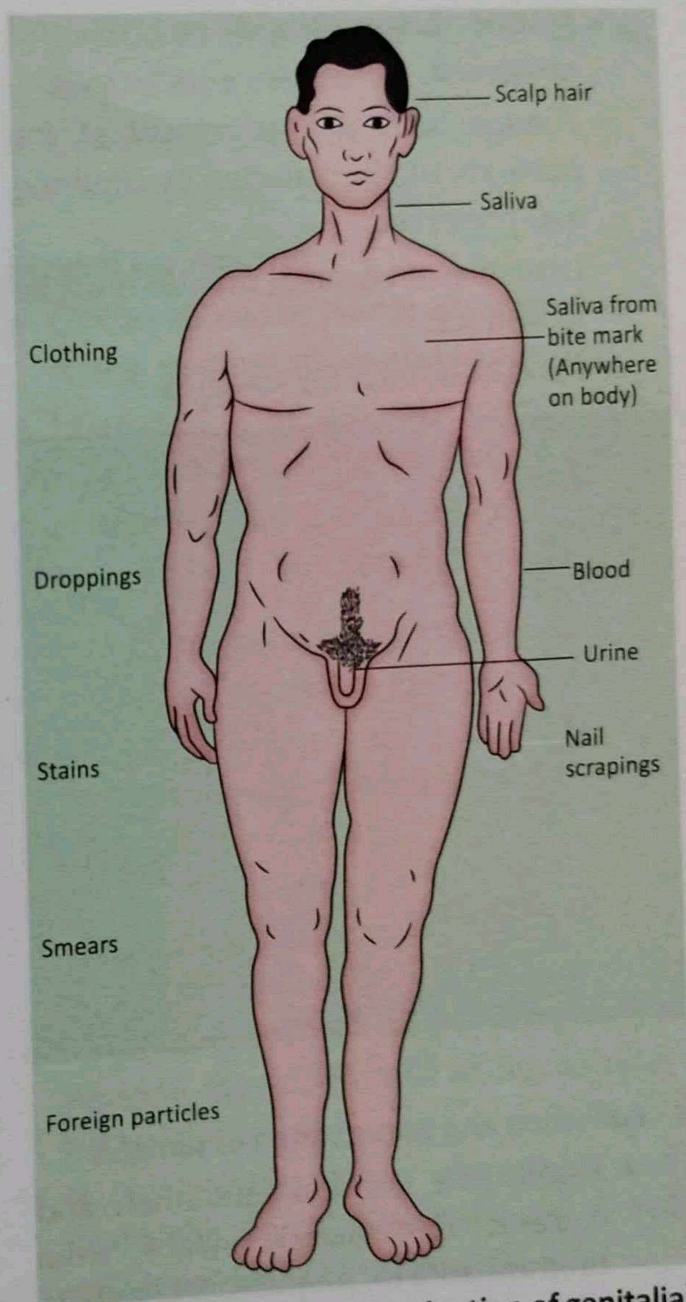
- Date, time and place of offence.
- Change of dress or bath or washing private area.
- Explanation for injuries in the body.

❖ General physical examinations

- Vitals, for examination of pulse, BP, temperature, respiratory rate.
- Identification marks
- General behaviour
- State of consciousness: Drunken or intoxicated.
- Clothes: Blood, semen, saliva, hair, or mucus, tears, or loss of buttons. These

should be noted and collected and preserve for further analysis.

- Marks of struggle: injuries should be noted.
- Nail scrapings should be examined for blood, epithelial cells and semen.
- Pubic hair: Cut and collect the matted pubic hair
- Venereal diseases



❖ Local examination (examination of genitalia)

- Development: Look for any abnormality of the genitalia and potency.
- Check for any scratches, bruises or abrasions on the genital area due to

victim's struggle to prevent penetration. There may be abrasions on the glans penis.

- Forceful penetration into a non-lubricated vagina may cause tears of prepuce or frenulum.
- Dried blood stains may be present on the shaft of penis, scrotum, and adjacent part.
- Matted hairs should be cut and preserved.
- Foreign hairs if any present at the pubis should be collected by combing and preserved.
- Existence of venereal disease must be looked for.
- Penis examined for smegma



Fig: Smegma

❖ Collection and preservation of samples

- Blood, hair (matted pubic hair and combed free hairs), swabs from urethral orifices, prepuce, penile shaft, scrotum, pubic area and inner part of thigh and nail scrapings.

- ❖ **Provisional and final opinion:** If sample of provisional opinion suggests there is nothing to indicate that above examined

person is incapable to perform sexual intercourse. But final opinion is given after getting the report from FSL.

23.2 Medicolegal Aspects of Sexual Offence

Incest

Incest means it is the sexual intercourse by a man with a woman who is closely related to him by blood. That means prohibited degree of relationships.

Example: daughter, granddaughter, sister, stepsister, aunt, mother.

Types of Incest

1. **Electra complex:** Sexual act between father and daughter.
2. **Oedipus complex:** Sexual act between mother and son.
3. **Pharaonic complex:** Sexual act between brother and sister.
4. **Rare types:** Sexual act between father and granddaughter, mother-grandson, uncle and niece.

Victims of incest are usually children.

In India incest as such is not an offence

Adultery

Sexual intercourse with the wife of another man without the consent or connivance of that man constitutes adultery. In such case, the wife shall not be punished as an abettor. **This is decriminalised.** It can be a strong evidence of divorce. (S.497 IPC).

It is a serious professional misconduct. If adultery committed by a doctor is confirmed, his medical registration may be cancelled, and the doctor's name may be removed permanently from a medical register. He will not be allowed to practice in his whole life (professional misconduct).

Unnatural Sexual Offence

S.IPC 377 – It deals with unnatural sexual offences and is as follows :

Whoever voluntarily has carnal knowledge (sexual intercourse) against the order of nature with any man, woman or animal shall be punished with imprisonment for life or either description for a term which may extend up to 10 years and shall be liable for fine. Penetration is sufficient to constitute the crime.

Unnatural Sexual Intercourse

1. Sodomy
2. Buccal coitus : If non-consensual, below 18 years
3. Tribadism (non-consensual, below 18 years)
4. Bestiality

SODOMY (Sin of Sodom)

Sodomy: It is anal intercourse a with a man or a woman. Heterosexual anal intercourse (b/w man and woman) is called **Buggery**.

Gerentophilia: If the passive agent is an adult

Paederasty: When the passive agent is a child, who is known as **catamite**. A **paedophile** is an adult who is involved in repeated sexual activities with children.

Eunuchs: They are male prostitutes consist of 2 types :

- ❖ **Zenanas:** They are (male prostitutes and live with female attire, have the intact genitalia and do sodomy)
- ❖ **Hijras:** They are castrated males. they are castrated before puberty.

Legal aspects

1. If the passive agent is a female and is done without consent, this sodomy is come under rape as per new definition of rape.
2. If the passive agent is a female and she is under 18 years, again it is rape (statutory rape).

3. If the victim is below 18 years and irrespective of gender if it comes under sexual assault (POCSO), active agent is punished.

4. If both active and passive agents are above 18 years and doing the sexual act with consent- then this is not a crime.

Examination of Passive agent (Non-habitual)

- ❖ The examination of passive agent is conducted in a similar way as like an alleged rape victim.
- ❖ Consent is needed.
- ❖ General history is taken.

General Examination

- ❖ Clothes should be examined for tear, blood stains, seminal stains and faecal stains.
- ❖ Injuries due to general violence, size, shape and location are noted.
- ❖ Clothes should be air dried and preserved in plastic bags and should be sent to FSL.

Anal Examination of Passive agent

Position of victim (passive agent) – knee elbow

- ❖ There may be linear abrasions varying in number, are seen from the margin to the inner aspects of anus.
- ❖ If is sudden violence, a **triangular bruised tear** at the posterior area of the anus, with its base is externally the rim of anus itself.
- ❖ Anal intercourse from an anterior position may cause tear in the anterior part of the anus.
- ❖ If the injuries or tear are tender and bleeds on touch then indicates recent penetration.
- ❖ The lesions are big in children as they possess small anus compared to the penile size.
- ❖ Bloods stains may be present around the area.

- ❖ Pain may be there during walking and defecation.
- ❖ On examining the anus, lubricant matter, seminal fluid, pubic hair are seen.

Habitual Passive Agent

1. The shaving of hair at the anus is seen.
2. The skin about anus become smooth and thickened.
3. The muscles of the anus lose their tone, and do not contract so readily.
4. Dilatation and laxity of anus.
5. Slight depression of buttocks towards anus as due to the absorption of fat.
6. Piles, anus fissures are very common.
7. Presence of venereal diseases.

Specimens to be collected

1. Blood
2. Urine
3. Pubic hair
4. Anal and perianal swab
5. Nail clippings

Examination of Active agent

- ❖ Same procedure as followed in the examination of accused in rape.
- ❖ Note for peculiar smell transferred to the penis, traces of faecal matter and lubricant on the penis.
- ❖ Injuries like abrasions on the prepuce, glans penis, tearing of frenulum, redness and swelling of penis.
- ❖ Penile swabs and washings are taken and examined for detection of anal mucosal cells of the victim, semen, blood and faecal matter.
- ❖ DNA profiling is done with anal mucosal cells and blood.

Buccal Coitus (Coitus per os or sin of Gomorrah)

Male organ (penis) is introduced into mouth of another male or female usually of a young child.

This is otherwise called Fellatio. Faint abrasions may be seen on the penis.

Sexual Oralism

It is obtained by applying mouth to sexual organs. Sucking male organ is called **fellatio** and licking female genital is called **cunnilingus**. Oral stimulation of anus is called **anilingus**.

Lesbianism (Tribadism)

- ❖ Female homosexuality is called lesbianism or tribadism.
- ❖ It is the sexual gratification obtained by a woman by sexual contact with another woman.
- ❖ This is done with the acts of simple kissing, generalised body contacts, deep kissing, manual manipulation of breasts and genitalia, genital apposition, friction of external genital organs, sucking of breast and external genitalia.
- ❖ Many lesbians are masculine in type may be due to endocrine disturbances, and are indifferent towards the opposite sex.

Legal aspects

- ❖ Tribadism is not an offence in India if both the partners are above 18 years.
 - ❖ If any one of the partners is below 18 years, this is considered as sexual assault as per POCSO Act.
 - ❖ It is a valid reason for divorce.
- UN Human Rights Commission passed its first resolution recognising the rights of community **LGBTQAI** (lesbian, gay, bisexual, transgender, queer/questioning, asexuals and intersex).

In India September 2018, Supreme Court of India decriminalised section 377 to IPC. Supreme Court in its order ruled that unnatural sex between consenting adults (above 18 years) is not a crime.

IPC 377 only deals with unnatural sexual offence with children and animals in present situation.

Homosexuals can live together in India, but their marriage is not legalised.

Bestiality

- ❖ It is the sexual intercourse by a human being with a lower animal.
- ❖ Animals such as calves and sheep are commonly used due to their small size. Other animals like chicken, ducks, geese, cows, mare, she-asses and mares are also used.
- ❖ Vaginal intercourse is most common. Other orifices like anus and nose are also involved.
- ❖ Mostly seen in persons with mental abnormality or persons going with the cattle alone.

Signs in the Accused

- ❖ Animal faeces, vaginal secretions, or hair may be present on the penis.
- ❖ Marks of injuries due to the kick or teeth or claws.
- ❖ Stains of animal blood at the genitals or clothing.

Signs on the Animal

- ❖ Presence of human spermatozoa in the vagina of the animal.
- ❖ Human hairs are present at genitals of animal.
- ❖ Injuries, abrasions or lacerations of genitals.
- ❖ Presence of gonorrheal discharge from the vagina of the animal.

Sexual Perversion (Paraphilia)

Paraphilia (sexual perversion or sexual deviation) are the acts from which complete sexual gratification is obtained from acts other than sexual intercourse.

Common paraphilias

- ❖ Sadism
- ❖ Masochism
- ❖ Fetichism
- ❖ Transvestism (eonism)
- ❖ Necrophilia
- ❖ Frotteurism
- ❖ Undinism (urolagnia)
- ❖ Voyeurism
- ❖ Exhibitionalism (onanism)
- ❖ Trolism
- ❖ Uranism

SADISM (Active Algolagnia)

- ❖ It is the sexual gratification obtained or increased from acts of physical cruelty or infliction of pain upon one's own partner.
- ❖ It is commonly seen in men.
- ❖ To attain sexual gratification, the sadist may bite, beat, whip, produce cuts, cigarette burns, etc.

Lust Murder

- ❖ It is the extreme version of sadism in which sadist may kill his sexual partner (murder may equitant as coitus) and mutilate her body.
- ❖ He may cut her breast or nipples, which may be accompanied by erection and ejaculation.
- ❖ Sometimes he may copulate with dead or nearly dead body.

Necrophilia

- ❖ In this condition, there is a desire for sexual intercourse with dead bodies.
- ❖ It is commonly done in newly buried body or a body awaiting burial.

Necrophagia

- ❖ This is the extreme degree of sadism, in which person after mutilating the body, sucks or licks the wounds, bites the skin, drinks the blood, and eats the flesh to derive sexual pleasure.

Both necrophilia and necrophagia are punishable under S.297 IPC.

Masochism (Passive Algolagnia)

- ❖ This is a condition opposite to sadism.
- ❖ In masochism, sexual gratification is obtained by being beaten or tortured, humiliated and dominated by the sexual partner.
- ❖ It is usually seen in males and rarely seen in females.

Algolagnia: It is sexual pleasure related to pain. Sadism and masochism together called bondage.

Bondage: This is a condition in which female partner amputates the penis of the male partner. This is called Robbit syndrome.

Fetichism

- ❖ It is an object for sexual stimulation.
- ❖ In this, person experiences sexual excitement leading to orgasm from part of the body of a woman or some articles belonging to her that normally have no sexual influence on the mind.
- ❖ It is commonly seen in males as they use the undergarments like bras, petticoat, stocking, panty hose of female as an object for sexual stimulation.
- ❖ The person or fetish may steal the undergarments (fetish burglary).

Transvestism or Eonism

- ❖ It is also called cross dressing.
- ❖ In this perversion, sexual gratification is obtained by wearing the clothes of opposite sex.
- ❖ The person wants to be recognised and identified as a member of opposite sex.

Frotteurism

- ❖ It is a sexual deviation type, in which a person obtains his sexual gratification by rubbing (contact) his private parts against a female body.
- ❖ It is punishable under S. IPC 354A.

Undinism

- ❖ In this type, sexual pleasure is obtained by witnessing the act of urination by opposite sex, or same sex.

Urolagnia: The same sexual pleasure is obtained by urinated upon by loved ones.

Coprophilia or coprolagnia: This is a sexual pleasure obtained by smell, site or touch of faeces or seeing defecation.

Exhibitionism

- ❖ This is a wilful exposure of genitalia in a public place in the presence of others. It may be or may not be associated with masturbation.
- ❖ In this, person may expose himself in front of children or opposite sex.
- ❖ S.IPC 294 says exhibitionism is punishable (3 months – imprisonment).

Types of exposing

Flashing: Momentarily exposing private parts.

Mooning: Exposing bare buttocks.

Streaking: Running naked in public

Voyeurism or Scopophilia

- ❖ In this perversion, sexual gratification is obtained by seeing the private parts of the opposite sex, or watching sexual intercourse.
- ❖ This is called 'peeping Tom'.
- ❖ It is commonly seen in males.
- ❖ S.IPC 354C mentions the punishment of voyeurism, which is of 3 to 7 years in jail.

Legal side

Behaviour	Punishment	Punishment
IPC 294	Exhibitionism	Up to 3 months
IPC 297	Necrophilia, necrophagia	1 year, fine or both
IPC 354	Indecent assault outrage the modesty of a woman	Up to 5 years & fine
IPC 354A	Frotterism	1-3 years
IPC 354C	Voyeurism	3-7 years
IPC 354D	Stalking	1-3 years
IPC 509	Intends to insult the modesty of a woman by uttering words, makes any sounds or exhibit any object.	1 year & fine

23.3 Protection of Children from Sexual Offences (POCSO) Act 2012

- ❖ It is passed in 2012 to comprehensively deal with the issue of sexual offences against children.
- ❖ In this act, children means male or female less than 18 years. (it is a gender neutral law).
- ❖ It protects the children from sexual assault, sexual harassments and using a child for pornography.

Sexual assault

- ❖ Touching the private part with sexual intent.
- ❖ If a person with sexual intent makes a child touch the private parts of another person is also a sexual assault.
- ❖ Sexual assault does not involve penetration.
- ❖ Penetrative sexual assault is a more serious offence than sexual assault. It is considered as aggravated sexual assault.

- ❖ Also the sexual offence is committed by a police, by a member of armed force, security officers and public servants is aggravated sexual offence.

Sexual Harassment

A person with sexual intent commits a crime like—

- ❖ Utters any word or makes any sound, so as to be heard by the sound.
- ❖ Makes any gestures, or exhibits any object or part of the body so as to be seen by the child.
- ❖ Makes the child exhibit his or her body.
- ❖ Shows anything to the child for pornographic purposes.
- ❖ Repeatedly contacts a child either directly or through electronic or other media.

Use of Child Pornography

Sexual gratification includes—

- ❖ Showing the sexual organs of a child.
- ❖ Using a child in real or stimulated sexual acts with or without penetrative sexual assault.
- ❖ Showing a child in an indecent or obscene way.

Punishments

- ❖ Punishment for committing a sexual assault on a child is minimum: 3 years – 5 years and fine.
- ❖ Punishment for penetrative sexual offence is 7 years of imprisonment to life imprisonment and fine.
- ❖ Punishment for aggravated sexual offence, 5 years to 7 years and fine.
- ❖ Aggravated penetrative sexual assaults in a child are punished with minimum 10 years of rigorous imprisonment up to life time imprisonment and fine.
- ❖ Punishment for sexual harassment of a child is imprisonment of 3 years as well as fine.

- ❖ Punishment for using a child for pornography, imprisonment of 5–7 years, an fine.

Recording of Statement of a Child

- ❖ No child can be detained in the police station in the night for any reason.
- ❖ Statement of the child is recorded at the residences or the place of his choice.
- ❖ As far as it is done by a woman police officer.
- ❖ The police men should not be in the uniform.
- ❖ Ensure that the child should not come in contact with the accused.
- ❖ Ensure that the identity of the child is protected.

Medical Examination

- ❖ It is done under S.CrPC 164A
- ❖ By a woman doctor if the victim is a girl child.

- ❖ In presence of child's parent/most trusting person.
- ❖ If they are not available, should be done in presence of a woman nominated by the medical institution.

Special Courts

- ❖ For getting speedy trial, the state Govt. has to constitute a special court in consultation with a High Court Judge.
- ❖ Create child friendly atmosphere in the court.
- ❖ Aggressive questions are not allowed.
- ❖ Permits frequent breaks during the trial.
- ❖ Child's identity should not be disclosed.
- ❖ Avoid repeated calling of child to court to testify.

Points to note

- ❖ As per POCSO Act the accused is gender neutral, that means it can be a man or woman of any age.
- ❖ The victim is also gender neutral.

Summary

Sexual Offence

A statutory offense that provides that it is a crime to knowingly cause another person to engage in an unwanted sexual act by force or threat.

Classification of Sexual offences

Natural Sexual offences

1. Rape
2. Adultery
3. Incest

Unnatural Sexual offences

1. Sodomy
2. Lesbianism
3. Bestiality
4. Buccal coitus

Sexual deviation/perversion

1. Fetischism
2. Transvestism
3. Sadism
4. Pedophilia

Sex linked offences

1. Stalking
2. Voyeurism
3. Sexual harassment

Rape

IPC section 375 defines rape

Any man is said to commit rape on a woman if he do

- ❖ **Penetrates his penis**, to any extent into the urethra, vagina, anus, mouth (UVAM) or make her to do so with him or any other person.
- ❖ **Inserts any other object of part of his body**: Not being the penis, into the vagina, urethra or anus of a woman or make her to do so with him or any other person.
- ❖ **Manipulates**: Any part of the body of the woman, so as to cause penetration into the urethra, vagina, anus or any part of a body, or make her to do so with him or any other person.
- ❖ **Applies his mouth**: Into vagina, urethra or anus of a woman or make her to do so with him or any other person under the circumstances falling under any of the following 7 situations :
 - Against her will
 - Without her consent
 - With consent, when such consent obtained by Fear of **death or hurt**.
 - With her consent when the man knows that he is not the husband and the consent was given because she believes that he is another man to who she lawfully married.
 - With her consent when at the time of giving such consent, by the reason of

unsoundness of mind or intoxication or administration by him personally or through another of any stupefying or unwholesome substance, she is unable to understand the nature and consequences of that to which she gives consent.

- With or without her consent when she is under 18 years of age, this is known as statutory rape.
- When she is unable to communicate consent e.g. when a male performs sexual intercourse with an unconscious woman, amounts to rape.

Pocso Act (2012)

- ❖ It is an act to protect children from offences of sexual assault, sexual harassment and pornography and provide for establishment of special courts for trial of such offences and for matters connected therewith or incidental thereto.
- ❖ The punishment varies according to the crime.
- ❖ The punishment for committing sexual assault on a child is minimum 3 years under POCSO which can extend to 5 years of imprisonment.
- ❖ Penetrative sexual assault is more serious offence than sexual assault.

Important Questions MCQ

1. Which among is coming under unnatural sexual offence

- | | |
|--------------|---------------|
| a. Rape | c. Voyeurism |
| b. Fetichism | d. Bestiality |

2. Definition of rape is

- | | |
|------------|------------|
| a. IPC 375 | c. IPC 299 |
| b. IPC 376 | d. IPC 302 |

3. Gang rape comes under

- | | |
|------------|-------------|
| a. IPC 375 | c. IPC 376D |
| b. IPC 376 | d. IPC 302 |

4. Indecent sexual assault comes under

- | | |
|------------|------------|
| a. IPC 375 | c. IPC 354 |
| b. IPC 376 | d. IPC 302 |

a. 2020
b. 2021
c. 2012
d. 2000

- Male under 18 years
- Female under 18 years
- Female under 16
- Male or female under 18 years

- a. Sex crime with penetration
- b. Sex offence by public servant
- c. Sex offence by public servant
- d. All the above

- a. Frouterism
- b. Voyeurism
- c. Lesbianism
- d. sodomy

a. IPC 294
b. IPC 297
c. IPC 290
d. IPC 390

a. Rape
b. Voyeurism
c. Lesbianism
d. sodomy

1. d	2. a	3. c	4. c	5. c
6. d	7. d	8. b	9. b	10. b

- Describe classification of sexual offence.
- Define Rape, describe the examination of rape victim and accused and its medicolegal aspects.
- Define the unnatural sexual offence, sexual perversion with medicolegal aspects.
- Describe POCSO Act.

- Explain POCSO Act.
- Explain sexual perversion.
- Explain rape.
- Explain IPC punishment for rape
- Explain examination of rape victim.

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Forensic Psychiatry

24.1 Common Symptoms Associated With Psychiatric Disorders

Forensic psychiatry

Psychiatry: It is the branch of science which deals with study, diagnosis and treatment of mental illness.

Forensic Psychiatry: Application of psychiatric knowledge for the purpose of administration of justice.

Commonly used Terminologies in Psychiatry

- ❖ **Psychosis:** It is a condition of serious and severe mental disorder in which a person has characteristics like loss of touch with reality, delusion, illusion, hallucination and loss of insight, impaired personality, abnormal behaviour, etc.
- ❖ **Neurosis:** It is a non-psychotic mental illness in which a person has insight and his behaviour is within social acceptable norms. This is a less serious disorder compared to psychosis. Examples are anxiety disorders (Phobia), obsessive compulsive disorders (OCD), hysteria, hypochondriasis, etc.
- ❖ **Delusion:** It is the false unshakable belief and not a fact.
 - **Delusion of persecution:** It is a very common delusion in which the person thinks that the people around him are trying to kill him or evil spirits are trying to kill him. This is seen in paranoid schizophrenia, dementia, depression and bipolar disorders.
 - **Delusion of grandeur or exaltation:** In this, the person thinks that he is master or like god or great personality.
 - **Delusion of love (erotomanic delusion):** One (usually female) thinks that a person with high socio-economic status is in love with him or her.
 - **Delusion of infidelity or jealousy:** It is seen more in man. The person thinks that his spouse is infidel or unfaithful, though in reality the wife is chaste or morally pure. This is also called Othello syndrome.
 - **Delusion of reference:** The person believes that everyone is looking at him or talking about him or the radio, TV, or the newspaper says about him.
 - **Delusion of influence or control:** The person thinks or believes that his thought, feelings and actions are being influenced or controlled by some outside agency or external agents.
 - **Delusion of nihilistic:** The person thinks that there is no world, he is already

dead or does not exist, he has no brain or head, etc.

- ❖ **Somatic/hypochondrial delusions:** The person is healthy but he believes that there is something wrong with his body.

MLA of Delusions

- ❖ Delusion is mostly taken as defence in the court of law.
- ❖ Tendency to commit suicide or homicide may be present.
- ❖ Delusion is never seen alone, it is present always with some deep seated psychiatric illness.
- ❖ A will made by a person who is suffering with delusion may be valid unless and until his delusion has no relation with disposal of property.
- ❖ **Illusion:** It is the **false interpretation** of external object which has real existence. It is seen in mental illness or toxic states.
Example: Assuming a rope as a Snake.
- ❖ **Hallucination:** It is the 'false sense of perception' without any external stimulus to produce it.

Types

- ❖ **Auditory hallucination:** The person hears noises and imagines that someone is speaking to him even as no one is present.
- ❖ **Visual hallucination:** The person may see something which in reality does not exist.
- ❖ **Gustatory hallucination (phantosmia):** The person feels taste even as there is no food in the mouth.
- ❖ **Olfactory hallucinations:** A person perceives smell which is not really there.
- ❖ **Tactile hallucination (formication):** A person imagines that insect or mice are crawling underneath the skin while there are none.

- ❖ **Psychomotor/kinaesthetic hallucination:** The person feels the movement of some part of the body when there is none.
- ❖ **Synaesthesia:** A stimulus perceived by sensory organ other than the one which should actually perceive it.

MLA

- ❖ A person may commit suicide or homicide in this.

Automatism (act without volition): There is no intention to do the act.

A conduct that is performed by a person whose consciousness is impaired to such an extent that he is not fully aware of his actions.

Obsession

It is a disturbance of thought.

A single idea or thought is constantly entertained by the patient, which is irrational but persists in spite of all efforts to drive it from his mind, e.g. checking and rechecking (repeatedly) whether a door has been bolted or not.

Impulse control disturbances

There is a sudden and irresistible force compelling a person to the conscious performance of an action without motive or forethought.

Types

- ❖ **Kleptomania** – Irresistible desire to steal articles of little or no value.
- ❖ **Pyromania** – Irresistible desire to set fire to objects.
- ❖ **Mutilomania** – Irresistible desire to hurt or torture animals.
- ❖ **Dipsomania** – Inability to stay off alcohol.

Some common terms

- ❖ **Affect:** Subjective and immediate experience of emotions at a given time.

- ❖ **Mood:** Pervasive emotions or feeling which is sustained.
- ❖ **Cognition:** If refers to higher mental functions such as memory, intelligence, concentration, orientation, etc.
- ❖ **Insight:** It is do with one's own mental condition.
- ❖ **Phobia:** It is an irrational fear of an object, situation or activity.
- ❖ **Panic:** It is an acute, intense and overwhelming episode of anxiety often associated with feeling of impending doom.
- ❖ **Stupor:** It a state of akinesia and mutism, relatively preservation of conscious awareness.
- ❖ **Confabulation:** It is a false memory that a patient believes to be true.
- ❖ **Psychopath:** It is an essentially normal individual, who has deep rooted abnormalities of personality, as a result of which the person is unable to conform to conventional standards of behaviour.

24.2 Lucid Interval

This is a temporary period of resolution of symptoms in a mentally unsound a individual. During this period, he will be held responsible for criminal acts.

This period is seen in 2 cases

- ❖ Head injury and insanity

Lucid interval - During insanity

It is the space of time between 2 episodes of mental illness, in which all the signs and symptoms of mental illness completely disappear. The person has clarity of mind, and he is able to judge and foresee the aftereffects.

It occurs in **bipolar disorders**. In bipolar disorders, lucid interval between 2 subsequent attacks of mania that is **depressive phase** corresponds to lucid interval.

MLA: A person is legally responsible for all civil acts and criminal acts done during lucid interval.

24.3 Civil and Criminal Responsibilities of a Mentally ill Person

Civil responsibility of a mentally ill

- ❖ **Consent:** A consent for surgery, sexual intercourse, MTP, and organ transplantation given by the mentally ill is not valid. As he is unable to understand the nature and consequences of the act. (S.IPC 90)
- ❖ **Evidence as a witness:** A mentally ill cannot be testified since he is generally considered as not competent for giving evidence.

During the period of lucid interval, he is considered as a competent witness and can be testified.

- ❖ **Testamentary capacity:** It is the ability to make valid will. That is whether he is capable of giving document declaring a person's property after his death. A person who makes the testament is called testator (male) and testatrix (female).

Testamentary capacity is the mental capacity or ability of a person to make valid will. Doctors are sometimes called upon to witness the execution of 'will' of a sick or an aged person :

- He should be sure that the testator is more than 18 years (major).
- He should ensure that the testator is not under the influence of somebody.
- He should ensure that the testator is of sound and disposing mind.
- The doctor should exclude any disease, pain, infirmity and influence of alcohol/ or drugs.

Will is valid: Will made in lucid interval is considered as valid because the person

of sound mind is able to judge, and foresee the consequences.

❖ **Management of properties:** If the owner of a property becomes insane and is incapable of managing his affairs with sound judgment, a relative or friend can approach the court for judicial inquisition. If it is proved that the person is insane, in course of such inquisition, the court can appoint a guardian or manager depending on the circumstances.

❖ **Marriage:** If it is proved that at the time of marriage, one of the parties (spouse) was insane, such marriage is declared as null or void. (As per law, marriage never took place, even if consummation has been accomplished).

Insanity developing after marriage, which was not present at the time of marriage, may constitute sufficient grounds for divorce, but not for nullity of marriage.

❖ **Business contract:** As per Indian Contract Act 1872, if it is proved that at the time of signing a contract one of the two parties was insane, the contract becomes legally invalid.

For the purpose of contract, a person is said to be of sound mind, if at the time of making contract, he is capable of understanding it and of forming a rational judgment.

He can make a valid contract at the time of lucid interval

Criminal Responsibility of A Mentally Ill

The criminal responsibility consists of two parts :

1. Mens rea (guilty mind)
2. Actus rea (criminal act)
 - The criminal responsibility is the responsibility for the criminal act.

- The law presumes that every person to be sane (sound mind) and responsible for his action.
- The physical act (actus rea) alone does not make a person guilty. The mental component (mens rea) is equally important.
- A sane person is held responsible for his criminal acts unless proved opposite.

The following legal procedures are not applied usually for a mentally ill:

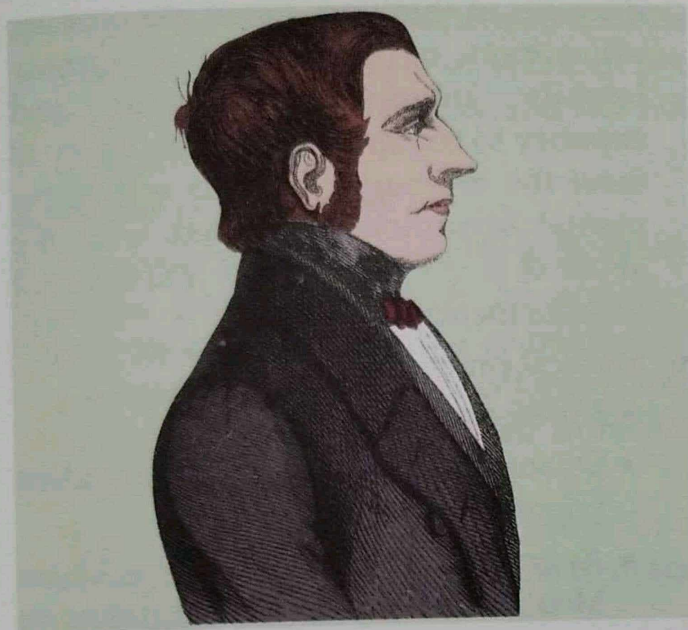
1. **Conviction (IPC 84):** A mentally ill cannot be charged for his crime.
2. **Trial:** (as per S. CrPC 329) A mentally ill person can plead his mental illness to avoid trial when the person is suffering with mental illness.
3. **Capital punishment:** A mentally ill person can plead his mental illness when he is a condemned prisoner is sentenced to death.
4. **Inquiry:** In above such cases the person is proved as mentally ill, he is found as not guilty and he is kept in psychiatric hospitals or other suitable place for custody.

Laws in relation with insanity

1. Legal test for insanity
2. S.IPC 84
3. Doctrine of diminished responsibility
4. Mental Healthcare Act

Legal test for insanity

1. McNaughton's test
2. Durham's rule
3. Curren's rule
4. American law institute test

McNaughten's Rule or Right or Wrong test

This is an English law dealing with criminal responsibility of a mentally ill person. It was enacted in England in 1843 McNaughten case.

Daniel McNaughten was a psychotic suffering from delusion of persecution, who was convinced that his problems would end only with the demise of Prime Minister Sir Robert Peel in January 1843. He fired at him with a revolver. But by mistake (of identity) the secretary to Prime minister, Edward Drummond was assassinated and Sir Robert Peel escaped.

McNaughten was arrested and tried. But the jury after testification by 9 physicians, "found him not guilty" by the reason of insanity.

After his acquittal, McNaughten was transferred from the prison to the state criminal lunatic assylum at Bethlem Hospital. In 1865, he died due to heart problem and diabetes.

McNaughten's rule: To establish a defence on the ground of insanity, it must be clearly proved that at the time of committing the act a party **accused was labouring under such a defect of reason**, from the disease

of mind. As not to know the nature and quality of the act he was doing or if he did not know that he was doing what was wrong or contrary to the law of the land.

It is adopted in Indian Law as S.IPC 84

"Nothing is an offence which is done by a person who at the time of doing it by the reason of unsoundness of mind, is incapable of knowing the nature of the act or that he is doing what is either wrong or contrary to law".

There are 4 situations to be noted

- ❖ **Firstly:** The person should have unsoundness of mind at the time of doing the crime. Unsoundness developed after the crime is not considered.
- ❖ **Secondly:** He was not knowing the nature and quality of the act due to mental illness.
- ❖ **Thirdly:** Even if he knows the nature and quality of the act, he does not know whether it is contrary to the law.
- ❖ **Fourthly:** The person does not know whether he is right or wrong.

Durham's rule or Product test

- ❖ It states that the accused is not criminally responsible if his unlawful act is the product of mental defect.
- ❖ It is broader than McNaughten's rule because it tried to cover all the 3 compartments of the functioning of mind, (cognition, conation, affect) and thus it covers all types of mental abnormalities.

Curren's Rule

- ❖ An accused is not criminally responsible if at the time committing the act he does not have the substantial capacity to regulate his conduct to the requirements of laws, a result of mental defect or diseases.

American Law Institute Test (ALI test) or substantial capacity test:

- ❖ As per this, the person must lack substantial capacity, not total capacity.

- ❖ This states "a person is not responsible for criminal conduct, if at the time of such conduct as a result of mental illness, or mental defect he lacks substantial capacity either appreciate the criminality of his conduct or to confirm/adjust his conduct to the requirements of the law."

The Doctrine of Diminished Responsibility

- ❖ In India (IPC 84) also in Britain, there is only **all** or **none** law that means either the person is not responsible for the crime, fully responsible for the crime.
- ❖ There is no concept of any middle path that is partial responsibility of crime.
- ❖ However, some countries provide middle path or partial responsibility for the crime.
- ❖ In this "the person accused of a crime is not held fully responsible, if by the reason of his mental illness, he did not premeditate or formed a specific intent to kill. He is charged for a lesser offence."

24.4 Mental Health Act (MHA)

The Mental Healthcare Act (1987) was enacted to amend the law relating to the treatment and care of mentally ill persons to make a better provisions with respect of their person and property and other connected matters. It replaced Indian Lunacy Act 1912.

Mental Healthcare Act (2017)

- ❖ This Act provides mental healthcare and services for person with mental illness and to protect, promote, and fulfill their rights during delivery of mental healthcare and services.
- ❖ This replaced Mental Health Act 1987

Determination of mental illness is done by nationally and internationally accepted guidelines.

1. Introduction

- ❖ The term mentally ill is replaced by a person with mental illness.

- ❖ Mental illness is defined as the substantial disorder of thinking, mood, perception, orientation or memory that grossly impairs judgment, behaviour, and capacity to recognise reality or ability to meet the ordinary demands of life, the mental condition associated with the abuse of alcohol, and drugs and does not include mental retardation.

❖ Medical practitioners:

- MBBS doctors
- Or an equivalent degree in the modern scientific medicine.
- Ayurveda PG in Manasaroga, Unani Moalijat/Nafsiyat, siddha (in sirappu maruthuvam, Homeopathy in Psychiatry).

2. Decriminalised:

- ❖ S.IPC 309 (attempted suicide): Anyone attempted to commit suicide was punished for 1 year imprisonment. This is now decriminalised as per MHA2017 S.115.
- ❖ Now the person who attempts suicide is considered as under severe stress, so shall not be punished, and shall be sent to care, treatment and rehabilitation to avoid the repetition.

3. Electroconvulsive Therapy usage and Psychosurgery:

- ❖ ECT should not be used in minors in normal cases but if the treating psychiatrist feels the necessity of ECT can do with the informed expressed consent of the guardian and prior permission from the mental healthcare Review Board.
 - ❖ ECT must be used with anesthesia and muscle relaxants.
 - ❖ ECT should not be given as part of emergency treatment.
- Psychosurgery:** It should not be performed to treat mental illness without

informed consent of patient and the review board. (Psychosurgery causes damage to some parts of brain in the treatment of mental illness, and it is not used nowadays.)

4. Advance Directive (AD):

- ❖ It is a document written by a mentally sound person in which he specifies how he wants to be cared or treated for a mental illness, if he is no longer able to make decisions for himself in future because of the mental illness.

It is a written document, comes into effect, when he becomes unable to make decisions.

5. Rights of a mentally ill: (chapter 5 of MHA): Every person with mental illness has the right to:

- ❖ Access good quality mental healthcare and treatment from appropriate establishments.
- ❖ Live with dignity
- ❖ Live in to be a part of society with no segregation or discrimination.
- ❖ Right to receive free legal services.

Rights related with treatment:

- ❖ Right to appoint an NR (nominated representative) for taking treatment decisions.
- ❖ Right to access mental healthcare and treatment.
- ❖ Right to information about the proposed treatment.
- ❖ Right to confidentiality.
- ❖ Right to access the medical records.
- ❖ Right to make complaints.

6. Authorities constituted to monitor

- ❖ **CMHA:** Central Mental Health Authority.
- ❖ **SMHA:** State Mental Health Authority.
- ❖ **MHRB:** Mental Health Review Board for each state.

7. Admission, Treatment and discharge

Admission

- ❖ **Admission of a person more than 18 years of age:** MO can admit the patient as an 'independent patient'. Any person above 18 years thinking that he is mentally ill and desires to be admitted is examined by the MO and can be admitted.
- ❖ **Admission of a minor:** A nominated representative of the minor or parents shall apply for admission. After the receipt of the application, the MO in charge of establishment can appoint 2 psychiatrists, examine independently and conclude the minor is suffering from serious mental illness.
- ❖ **Supported admission:** In case of a person with mental illness threatens to cause body harm to himself or behaves violently; the medical officer in charge shall admit him for 30 days, upon application by (near relative). After 30 days, he may or may not be discharged according to the condition.

Treatment

An independent patient shall not be given treatment without his informed consent.

Discharge

The psychiatrist who has been responsible for a person's care and treatment shall consult with the person with mental illness, and the nominated representative, and the family members with whom this person resides or shall consult with the psychiatrist expected to be responsible for the person's care and treatment in future in other establishments.

8. Responsibilities:

Police: All police officers in charge of a police station should give protection to the wandering person with mental illness.

The person cannot be detained anywhere but can be taken to nearest public health establishments and examined. The person is found to have mental illness should be brought to the nearest magistrate and can admit to an establishment as per the order of magistrate.

Prison authorities: The MO of a prison or jail shall send a quarterly report to the concerned board certifying that there is no prisoners with mental illness in the prison or jail.

9. Penalty and Punishments

❖ **Penalty:** Running a Mental Health Establishment without licence or registra-

tion: fine of Rs. 5,000-50,000, for second time, Rs. 50,000-2 lakh etc.

❖ Anyone who disobeys the provisions of this Act shall be punished with 6 months imprisonment and 10,000 fine and subsequent offence: 2 years and (Rs. 50,000- 5 lakh)

Differences Between True Insanity and Feigned Insanity

Mental status examination and compos mentis are coming under the duties of a Forensic psychiatrist.

Feigned insanity is the one which is pretended

Sl.No.	Features	True mental illness	Feigned mental illness
1.	Onset	Gradual	Sudden
2.	Signs and symptoms	Uniform, specific for some type of mental illness.	Not related to any particular type of mental illness.
3.	Activity	Present all time Whether the patient is being observed or not.	Present only when being observed.
4.	Facial expression	Peculiar vacant look	Not special, frequent changing
5.	Habits	Dirty and filthy	Not so
6.	Skin and lips	Dry and dirty	Normal
7.	Insomnia	Present	Absent
8.	Exertion	Can withstand exertion of fatigue, hunger.	Cannot withstand exertion for a few days and breaks down.
9.	Frequent examination	Does not mind	Resist for fear of detection
10.	Motive	Absent	Present

Summary

Forensic psychiatry

It deals with the application of psychiatric knowledge in the administration of justice.

Common psychiatric symptoms

- ❖ Delusion
- ❖ Hallucination
- ❖ Illusion

❖ Impulse

❖ Obsession

It requires understanding of the interface between mental health and law.

Responsibility of an Insane Person

Civil Responsibility

The question arises in following points :

1. Management of property and affairs

2. Insanity and contracts
3. Insanity and marriage contracts
4. Insanity and testamentary capacity
5. Consent and insanity
6. Competence of insane to be a witness
7. Guardianship

Criminal Responsibilities

An insane person may be exempted from criminal responsibility under the following situations :

- ❖ Unsoundness of mind must exist at the time of committing the crime, subsequent insanity is no crime.
- ❖ Unsoundness of mind must be to such an extent as to render the insane person incapable of knowing the nature of act or that the act he was doing was wrong or contrary to law.

McNaughton's Rule

An accused person is not legally responsible if it is clearly proved that at the time of committing the crime he was suffering from such a defect of reason from abnormality of mind, that he did not know the nature

and quality of the act, he was doing or that what he was doing is wrong.

Nothing is an offence which is done by a person who at the time of doing it by the reason of unsoundness of mind is incapable of knowing the nature of act or that he was doing what is either wrong or contrary to law.

Lucid interval

It is a period of mental clarity following psychiatric diseases.

Mental Health Act 1987,

The mental health care act was enacted to amend the law relating to the treatment and care of mentally ill persons to make a better provisions with respect of their person and property and other connected matters :

- ❖ It replaced Indian Lunacy act 1912
- ❖ Mental Healthcare Act (2017)
 - This act provides mental health care and services for person with mental illness and to protect, promote, and fulfill their rights during delivery of mental health care and services.
 - This replaced mental health Act 1987

MHA 1987	MHA 2017
Had fewer definitions	Expanded list of definitions including care giver and other mental health professional.
No proper definition of mental illness	Defines mental illness in accordance with the current scientific conceptualization.
Speaks only about the psychiatrist and medical practitioner as treating professionals.	The list of treating professionals include psychiatrist, clinical psychologists, psychiatric social worker, and alternative healthcare practitioners.
Speaks only about psychiatric hospital and psychiatric nursing homes as treatment facility.	Includes all sorts of establishments wholly or partly providing care to mentally ill including facilities where alternative healthcare practices are followed.
Does not provide detail of the constitution and systems of functioning of mental health authorities.	Specifies in detail regarding the constitution of mental health authorities and their functions.

MHA 1987

Emphasizes on procedure of acquiring license to establish and maintain a psychiatric hospital.

Does not provide standards by which a patient is to be diagnosed to be mentally ill.

MHA 2017

Lays down the procedure for obtaining registration for mental health establishments and outlines the procedure of supervision of its functions.

Provides international classificatory system by WHO as referential point for deciding whether a person is having mental illness or not.

Important Questions MCQ

1. **IPC 84 is based on**
 - a. Wallace rule
 - b. McNaughten's rule
 - c. Americal Law institute test
 - d. Curren's rule
2. **Delusion if**
 - a. Misinterpretation
 - b. False interpretation
 - c. Strong unshakable belief
 - d. Presumption
3. **Illusion is**
 - a. Misinterpretation
 - b. Perception
 - c. Strong Unshakable belief
 - d. Presumption
4. **Lucid interval is seen in**
 - a. Injuries
 - b. Asphyxia
 - c. Mental illness
 - d. Hypothermia
5. **Klepto mania is a**
 - a. Misinterpretation
 - b. Impulse
 - c. Strong Unshakable belief
 - d. Presumption
6. **McNaughten was suffering with**
 - a. Mania
 - b. Neurosis
 - c. Schizophrenia
 - d. Delusion of persecution
7. **Criminal responsibility is absent in**
 - a. Impulse
 - b. Hypnotism
 - c. Voluntary drunkenness
 - d. Delirium
8. **Mental Health Act year**
 - a. 2020
 - b. 2012
 - c. 2017
 - d. 1912
9. **Pyromania is the irresistible thought to**
 - a. Kill animals
 - b. Fire things
 - c. Drink alcohol
 - d. Steal things
10. **Testamentary capacity is**
 - a. Make valid will
 - b. Right to ask questions
 - c. Right to information
 - d. Right to get treatment

Answer key

1. b 2. c 3. a 4. c 5. b 6. d 7. d 8. c 9. b 10. a

Learning Objectives

- Describe the symptoms commonly associated with Psychiatric disorders and Lucid interval.
- Describe the civil and criminal responsibilities of mentally ill.
- Describe Mental Health Act.

Important SAQ

- Explain Lucid interval.
- Explain the civil responsibilities of a mentally ill. Differentiate between true insanity and feigned insanity.
- Write about Mental Healthcare Act.
- Explain McNaughten's rule.

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Forensic Science Laboratory

25.1 Hierarchy and Major Divisions of Forensic Lab Services

- ❖ FSL or forensic science laboratory is the lab established to carry out scientific examination and evaluation of evidence for legal purpose.
- ❖ A forensic science laboratory is a scientific laboratory specialising in forensic science. Such laboratories may be run by private companies or the government but are often associated with the law enforcement infrastructure of a country.
- ❖ Physical evidences may be :
 - Macroscopic evidences
 - Microscopic or trace evidence

FSL deals with the lab examination of various physical evidences recovered from the crime scene.

FSL is the wing of Ministry of Home Affairs of India and under Directorate of Forensic Science Services.

FSL in India

1. Central Forensic Science Laboratory.
They are :
 - CFSL Kolkata (first and oldest FSL)
 - CFSL Hyderabad
 - CFSL Chandigarh

- CFSL New Delhi
- CFSL Mumbai
- CFSL Rajkot
- CFSL Pune

2. **SFSL**: State Forensic Science Laboratory.
3. **RFSL**: Regional Forensic Science Laboratory.
4. **MFSL**: Mobile Forensic Science Laboratory.

Functions of FSL

1. To examine evidence material.
2. To help the investigation officer for scientific guidance in crime detection.
3. To help the investigation officer to collect evidences by visiting scene of crime.
4. To train the investigating officer for use of modern and sophisticated techniques in crime detection.

Divisions of FSL

1. **Biology** - Identification of body fluids, hair and plant material.
2. Chemistry
3. Physics
4. **Toxicology** - It undertakes chemical analysis of viscera, and body fluid or suspicious articles. Forensic toxicology deals with medical and legal aspects of

harmful effects of the chemicals on the human body.

5. **Serology** - It undertakes blood groups estimation.

6. **Ballistics division** - It examines of firearms and explosives.

7. Explosives division

8. DNA profiling

9. Dactylography

10. Polygraph unit

11. Narcotic unit

12. Photography

13. Forensic pathology

Tools and Techniques used in FSL

1. Microscopy

2. Chromatography

3. Electrophoresis

4. Spectrometry

5. Spectroscopy

6. Photometry

7. Flame emission photometry

8. Luminescence

9. Neutron activation analysis

10. DNA profiling

11. Dactylography

12. Recent methods of interrogations like polygraph, narcoanalysis and brain mapping.

13. Photography

Principles of Forensic Science

❖ Scene examination

❖ Locard's exchange principle

❖ Evidence recovery

❖ Chain of custody

❖ Sample analysis

❖ Blood pattern analysis

❖ Damage

❖ Fingerprints

❖ Foot wear

❖ Trace evidence

❖ Fire investigation

❖ Firearms

Importance of Physical Evidence

❖ It is useful as it helps to decide whether a crime is committed or to decide who committed the crime.

❖ Common examples are weapons, bullets, blood, semen, saliva, hair, clothes, finger prints, foot prints and documents.

❖ In case of poisoning/food poisoning, chemical analysis of viscera or body fluids is done to know the nature of poison and chemical analysis of food/utensils/clothes is done for corroborative evidence.

❖ In assault and murder, examination of weapon/object is done to detect the crime & blood grouping from blood stains, hair in the victim's hand, saliva on cigarette butts and cloth examination to trace the assailant.

❖ In burn deaths, Examination of clothes/skin is done for smell of kerosene, examination of metallic object and teeth and bones for identification of charred bodies.

❖ In firearm injuries, examination of missile is done to know the nature and type of weapon.

❖ In hanging and strangulation, matching of ligature is done.

❖ In drowning, detection of diatoms in body tissues and water is conducted.

❖ In sexual offence, examination of vagina fluids, blood stains or seminal stains, hair, epithelium, blood grouping and cloth is conducted.

❖ In road traffic accidents, blood grouping, tyre marks, grease, mud, blood, tissue, glass piece, hair, clothes, paint etc. are examined.

- ❖ **Identification cases:** Finger prints, foot prints, hair, tattoo, semen, cloth, blood, bone, teeth, etc.
- ❖ **Disputed paternity:** Blood grouping and DNA finger printing.
- ❖ **Burglary:** Examination of paint, algae, vegetable matter, glass fragments, cloths etc. is done.
- ❖ **Forgery:** Examination of documents, paper, ink, pencil and type writer.
- ❖ Identification of hand writing.

Analytical Techniques

Microscopes: Comparison microscope, dark field microscope, electron microscope, fluorescence microscope, polarising microscope, scanning electron microscope, x-ray microscope etc. are commonly used to magnify small objects that cannot be seen by naked eyes.

Chromatography: It is an important technique to separation identification and purification of a mixture. It is based on 2 different media-stationary phase and mobile phase. The speed at which each substance is carried along by the mobile phase depends on its solubility and its affinity for the sorbent. It is very helpful to detect poisons and chemicals. Thin layer chromatography and paper chromatography are used for the separation of proteins. Gas chromatography is used for alcohol, ester, lipids and amino groups.

Electrophoresis: It is a technique using a separate mixture of ionic solutes by differences in their rate of migration in an applied electric field. The electrically charged protein components move on the phase plate and at the end the plate is treated with colouring agent causes appearances of visible characteristic bands specific for a particular protein.

Spectroscopy: There are a lot of spectroscopy methods based on various types of interactions between radiation and matter, among which vibrational spectroscopy deserves special attention. These are used for identification of various hemoglobin.

Spectrometry: Colorimeter, U.V. & I.R., spectrophotometry, mass spectrometry, emission spectrophotometry and atomic absorption spectrometry are the common quantitative and qualitative analytical spectrometry.

Neutron Activation Analysis (NAA): It is an isotope specific analytical technique for the qualitative and quantitative measurement of chemical elements.

Woods lamp: It is a source of long wave UV light (black light). Light is filtered through a filter paper made of barium silicate with nickel oxide. Normally skin does not shine under UV light or will be slightly blue. Its clinical uses are to detect corneal abrasion and bacterial or fungal infections (Tinea capitis). In forensic tests, it is used to examine crime scenes and clothing for crime investigation.

25.2 Newer Techniques and Recent Advances – Polygraphy, NARCO analysis, DNA Profiling

1. Polygraph (Lie Detector)

It is based upon the principle that is telling lie and if there is a fear that lie is detected the emotional fear results in the stimulation of sympathetic nervous system that causes physiological changes and some of the changes can be recorded.

It is commonly called as lie detector.

It is a device which simultaneously records several physiological parameters while a series of questions are asked.

- ❖ Blood Pressure
- ❖ Pulse

- ❖ Heart rate
- ❖ Respiratory rate
- ❖ Electric conductance of the skin
- ❖ Sweating

These measurements are believed to be the indicators of anxiety due to sympathetic stimulation that accompanies the telling of lies. Polygraph test is also known as psychophysiological detection of deception (PDD) examination.

Testing Procedure

- ❖ A polygraph test takes 1-3 hours.
- ❖ Polygraph measuring device pneumographs, sphygmomanometer and electrodes are placed on the person or subject during the pretest interview.
- ❖ After the pretest (preparing the subject about the polygraph and also to check the physiological response towards normal questions and later it is used as control questions (CQ)), the sphygmomanometer is inflated and recording of responses begins.
- ❖ A short period of 10-15 seconds is used to observe the initial respiratory responses.
- ❖ Then the examiner starts asking questions. His responses are recorded after each question, the subject will be given 15-20 seconds until the response to the last question is finished and physiological response closer to the base line. When the questions of the first chart end, the cuff deflates.
- ❖ There are **three** important techniques:
 - Relevant/irrelevant technique (RI) - common
 - Control question technique (CQR) - used in criminal investigations purpose
 - Concealed information technique

Relevant/ Irrelevant Technique

Here 2 type of questions are used in this, they are relevant and irrelevant. Deceptive

subjects are assumed to have significantly greater reaction to the relevant questions than the irrelevant questions. An underlying assumption of this technique, non-deceptive subjects should have an equal response to all questions, because being non-deceptive they would not fear questions about the crime any more than irrelevant questions.

Control Question Technique

This is very common technique used in investigations of a specific issue. This is the questions that the most people lie about.

Results and Interpretation

If the physiological response to (Relevant questions) are greater than those to CQ. It means the person is lying.

If the physiological responses to CQ are greater than those to RQ, it means the person is not guilty.

MLA

1. The polygraph test is administered with the consent of the accused.
2. If the accused agrees for the test he should be given access to a lawyer.
3. Consent should be recorded before judicial magistrate.
4. The recording of the test shall be done in a hospital in the presence of a lawyer.

2. Narco analysis

- ❖ It is a process of obtaining information from an individual in a sleep like state.
- ❖ It is a procedure of investigation of mental content of a person, done after application of simple general an anesthetic drug.
- ❖ The principle of this test is that, at a point very close to unconsciousness, the subject would be mentally incapable of resistance to questioning and incapable of inventing falsehood that he has used to conceal his guilt.

- ❖ It uses the light anesthetic drugs like (IV):
 - Sodium Pentothal - called truth drug or truth serum
 - Scopolamine hydrobromide
 - Sodium seconal
 - Benzodiazepines

Team required

The team comprises anesthetist, psychiatrist, clinical or forensic psychologist, audio videographer, and supporting nursing staff.

Adverse effects

- ❖ Sodium Pentothal causes laryngospasm, shivering, and delirium which may occur during recovery.
- ❖ It can cause intermittent porphyria.

3. Brain Mapping or Brain Fingerprinting

- ❖ Brain fingerprinting determines if specific information is present in the brain of criminal regarding the criminal act.
- ❖ Quantitative EEG (QEEG) measures the electrical activity of the brain which is known as Brain Mapping.
- ❖ Procedure: An elastic cap of 19 electronic sensors is placed on the shaven scalp of

the subject and EEG measuring device. The subject is shown stimuli of consisting of sounds, waves, phrases or pictures on a computer screen.

- ❖ EEG responses are recorded and studied. There is no need of verbal response of the subject.
- ❖ If the suspect has the prior knowledge of any event, (crime) the brain would recognise, the scene of crime and weapon, and thus the response shows memory related P300 waves.
- ❖ Later used MERMER (Memory Encoding Related Multifaceted Electroencephalographic Response) which includes P300 with additional waves.

Uses

1. To find out whether the suspect is telling truth or to reveal facts in criminal investigation.
2. Medical: For the evaluation, and early detection of detection of Alzheimer's and other neurodegenerative disease DNA finger printing is included in the chapter identification (chapter 18.5).

Summary

Forensic Science Laboratory (FSL)

It is a specialized scientific facility focused on forensic science.

These labs may be operated by either private companies or the government but are commonly linked to a country's law enforcement system.

FSL or forensic science Laboratory is the Lab established to carry out scientific examination and evaluation of evidence for legal purpose.

FSL are playing a crucial role in India's criminal justice system, providing vital

assistance in investigating and resolving criminal cases.

These labs are responsible for analyzing various types of evidence ranging from biological samples to digital media and trance evidence.

Objectives

- ❖ Providing scientific assistance to justice delivery system.
- ❖ Examination of referred and complicated crime exhibits.
- ❖ Research development for evolving better and newer methodologies.

Polygraphy

It is used as an interrogation tool for identifying criminal suspects.

It is also called as lie detector or polygraphy is based on the theory that lying produces particular emotions which produce corresponding measurable physiological responses.

It usually records several physiological indicators such as blood pressure, pulse, respiration, and skin conductivity while a person is asked and answers a series of questions.

Narcoanalysis

This test involves the intravenous administration of a drug (such as sodium pentothal, scopolamine, and sodium amytal) that causes the subject to enter into various stages of anesthesia that is hypnotic or sedated state in which their imagination is neutralized.

In his hypnotic state the accused is understood as being incapable of lying and is expected to divulge information that is true.

Important Questions**MCQ**

- 1. First FSL formed is**
 - a. CFSL New Delhi
 - b. CFSL Kolkata
 - c. CFSL Mumbai
 - d. CFSL Pune
- 2. FSL operates under**
 - a. State govt.
 - b. Under police force
 - c. Under Central Ministry of Home Affairs
 - d. Under Governor
- 3. Truth serum is used in**
 - a. Narco-analysis
 - b. Polygraph
 - c. Brain mapping
 - d. Finger prints
- 4. MERMER is used in**
 - a. Narco-analysis
 - b. Polygraph
 - c. Brain mapping
 - d. Finger prints
- 5. RI is a method used in**
 - a. Narco-analysis
 - b. Polygraph
 - c. Brain mapping
 - d. Finger prints

Answer key

1. b 2. c 3. a 4. c 5. b

Learning Objectives

- Hierarchy and major divisions of Forensic Science Laboratory.
- Describe the techniques of Polygraphy, Narco analysis, Brain mapping, DNA profiling.

Important SAQ

- Explain FSL.
- Explain the functions of FSL.
- Explain the Brain mapping.
- Explain Narco analysis.
- Explain polygraph techniques.

Laws, Acts, Rules and Regulations

26.1 Clinical Establishments Act

Clinical Establishments (Registration and Regulation) Act 2010

- ❖ This Act provides for registration and regulation of clinical establishments in the country with a view to prescribe basic standards of facilities and services of a particular type being provided by the clinical establishments.
- ❖ A clinical establishment means a hospital, maternity home, nursing home, dispensary, clinic, sanatorium, or other institution that offers services, facilities, requiring diagnosis, treatment or care of illness, injury, deformity, abnormality, or pregnancy in any recognised system of medicine. It also includes laboratory and diagnostic centre, or any other place where pathological, bacteriological, genetic, radiological, chemical, biological, investigations or other services are provided.
- ❖ All clinical establishments across all recognised system of medicine including allopathy & Ayush, both in public and private sector.
- ❖ Clinical establishments owned, controlled or managed by Armed Forces are not included in this Act.

Important Features of this Act

- ❖ Assists in generation of reliable and comprehensive database for all types of clinical establishments in the country at district, state or national level.
- ❖ Helps to classify various clinical establishments into categories, determine category wise basic minimum standards.
- ❖ Assists govt. in obtaining information and data required from, clinical establishments for public health interventions including outbreak and disaster management.
- ❖ It establishes the multi-stakeholder bodies' namely national council for clinical establishments at national level, state council for clinical establishments at state level and district registration authority at each district. Implementation of the Act is done by respective state through state council and district registration authority.
- ❖ This act allows 2 step registration process– **Provisional registration** and **Permanent registration**. Provisional registration is done through a process of self-declaration, without any inquiry or inspection. Permanent registration would be undertaken after categorisation, classification and notification of category wise minimum standards.

- ❖ The Act places the entire process of registration and data of clinical establishments in the public domain which ensures transparency.
- ❖ Cancellation of clinical establishments occurs at any time, if the conditions of registration are not complied with.
- ❖ The Act may control or act as deterrent against quackery by introducing registration which is applicable only to clinical establishment of recognised systems of medicine and no one can run a clinical establishments without registration.
- ❖ It lays down provisions for healthcare providers to maintain records and reporting as prescribed and provide information and statistics that may be asked for by the authority.

Offences

- ❖ Whoever operates a clinical establishment without registration shall, on first contravention be liable to a monetary penalty up to Rs. 50,000.
- ❖ For second contravention, monetary penalty may extend to two lakh rupees.

26.2 State Ayush Registration

Board Rules and Regulations

- ❖ Ayush Registration Board oversees the registration and regulation of practitioners in the traditional systems of medicine like Ayurveda, Yoga, Naturopathy, Unani, Siddha and Homeopathy in India.
- ❖ It provides registration certificate to candidates who have obtained graduate degrees from recognized ayush medical colleges in order to legally practice medicine.
- ❖ The board is also tasked to detect and take legal action against quacks and fake certificate holders.

- ❖ Each state typically has its own Ayush Registration Board responsible for this purpose.
- ❖ They often establish guidelines for education, practice and ethical conduct within the field.
- ❖ These Boards also manage licensing, certifications and ensures adherence to safety and quality standards in healthcare services provided by practitioners of Ayurveda, Yoga, Naturopathy, Unani, Siddha and Homeopathy in India.

Functions of State Board of Ayush

The functions and regulations of each states board of Ayush registration can vary but here are some common aspects they typically handle.

1. Registration and licensing:

- Managing the registration process for practitioners in Ayurveda, Yoga, Naturopathy, Unani, siddha and Homeopathy ensuring they meet the required qualifications and standards.

2. Setting standards:

- Establishing guidelines for education, training and practice within the traditional systems of medicine, ensuring practitioners meet specific criteria.

3. Ethical conduct and regulations:

- Enforcing ethical standards and regulations to maintain the integrity of traditional healthcare practices and safeguard patient interests.

4. Quality assurance:

- Ensuring adherence to safety, hygiene and quality standards in healthcare services provided by registered practitioners.

5. Continuing education:

- Facilitating programs or requirements for ongoing education and skill enha-

ncement for RMP to stay updated with advancements in the field.

6. Complaints and disciplinary actions

- Addressing complaints or concerns against practitioners and taking disciplinary actions when necessary to uphold professional standards.

7. Promotion and awareness

- Promoting the benefit and importance of traditional medicine systems while raising public awareness about registered practitioners and their services.

26.3 Medicare Service Persons and Medicare Service Institutions (Prevention of Violence and Damage or Loss to Property) Act 2008

- ❖ This Act enacted to prevent acts of violence causing injury, or danger, to the life of persons engaged in medicare services as also damage to property belonging to medicare institutions, are on the increase in the country. As a result of such incidents against medicare persons, patients visiting hospitals have to suffer tremendously.
- ❖ This Act is enacted to protect the medicare service persons and institutions from violence and damage to property and impose punishment on the offender and for matter connected there with and incidental thereto.
- ❖ As per this act, 'Medicare Service Institution' means all institutions providing medical care to people, which are under the control of State or Central or Local bodies including govt. and private hospitals.
- ❖ 'Medicare persons' include registered medical practitioners, registered nurses, medical students, nursing students and paramedical employees.

- ❖ In this Act any act of violence against medicare service persons or damage to property in a medicare institution is hereby prohibited.

- ❖ Punishment: Any offender who is found guilty as per this Act is punishable with imprisonment of 3 years and also fine up to 50,000 or the amount twice the purchase amount.

26.4 Drugs and Cosmetics Act and Rules - Schedules Related to Poisons

- ❖ The Drug and Cosmetic Act 1940 – It regulates the import, manufacture, distribution and sale of all drugs in India.
- ❖ The primary objective of the Act is to ensure that the drugs and cosmetics sold in India are safe, effective, and conform to state quality standards.
- ❖ The related drugs and cosmetics rules, 1945 contain provisions for classification of drugs under given schedules and there are guidelines for the storage, sale, display and prescription of each schedule.
- ❖ According to this Act, the ingredients of the drugs, the formula and the quantity should be displayed in the label.

The Drugs and Cosmetics Rules 1945 – regulate the manufacture, import, distribution, sale and advertisement of drugs and cosmetics to ensure their safety, quality and efficacy. They cover a wide range of aspects including licensing, labelling, packaging and more to maintain standards in the pharmaceutical and cosmetic industries.

The rules classify drugs into following schedules:

- ❖ **Schedule C:** Biological and special products
- ❖ **Schedule E:** List of poisons
- ❖ **Schedule F:** Vaccines and sera
- ❖ **Schedule G:** Hormone preparations, anti-histamines and anticancer drugs.

❖ **Schedule H:** Drugs/poisons to be sold only on the prescriptions of a registered medical practitioner.

❖ **Schedule J:** List of diseases for the cure of which no drug should be advertised.

❖ **Schedule L:** Antibiotics, antihistamines and other recent chemotherapeutic agents.

Both schedule H and L drugs should not be sold by retailers except on a prescription of a registered medical practitioner.

26.5 The Occupational Safety, Health and Working Conditions Code 2020

Objectives: The objectives of this Act are to improve the working environment and working conditions in order to ensure and maintain the working capacity of employees as well as to prevent occupational accidents and diseases and eliminate other hazards from work and other working environment to the physical and mental health :

- ❖ This Act in India is aimed at ensuring the safety, health and welfare of workers in various industries.
- ❖ It covers the aspects such as working conditions, safety measures, welfare facilities, and regulate the working hours, overtime, and leave entitlements for the workers.
- ❖ This Act aims to create a healthy and safe environment for employees across different sectors.

1. **Welfare measures:** The Act emphasises the provisions of various welfare measures for workers in various work place, including canteens, restrooms, first aid facilities, and more depending on the nature of the workplace.

2. **Working hours:** It regulates the maximum number of working hours per day and week along with provisions of overtime pay and rest intervals.

3. **Safety measures:** The Act mandates safety measures in the work place, such as proper ventilation, adequate lighting, safe machinery operations, and protection against hazardous substances.

4. **Health and Hygiene:** It focusses on maintaining the health and hygiene of workers including provisions for medical examinations, cleanliness at the workplace and access to sanitation facilities.

5. **Employment of Women:** The Act includes specific provisions for the employment of women, ensuring their safety and suitable working conditions, including maternity benefits and restrictions on certain types of work during pregnancy.

6. **Inspection and compliance:** The Act facilitates regular inspections by authorised personnel to ensure compliance with the regulations. This helps in identifying any shortcoming and ensuring corrective measures are taken.

7. **Training and awareness:** It encourages training programs and awareness campaigns to educate both employers and employees about safety protocols, health measures, and their respective rights and responsibilities.

8. **Employee representation:** It may include provisions for the formation of safety committees or representation of workers to participate in discussions regarding workplace safety, and health related matters.

9. **Record keeping:** Employers are often required to maintain records related to accidents, safety measures taken, health examinations and other relevant documentations as per Act requirements

10. **Applicability and scope:** The Act typically covers a wide range of industries and

workplaces, ensuring its application to various sectors to maintain uniformity in safety standards across different work environments.

Offences and Penalties

1. **Non-compliance:** Failure to adhere to the provisions outlined in the Act regarding safety, working conditions, or welfare measures, can result in penalties.
2. **Unsafe conditions:** Creating or maintaining unsafe working conditions that endanger the health and safety of employees can lead to penalties.
3. **Non-payment of benefits:** Failure to provide entitled benefits such as overtime pay, proper leave or other welfare measures can result in penalties.
4. **Violations of regulations:** Any violations of the specific regulations outlined in the Act related to working hours, safety measures, or welfare facilities can lead to penalties.

Penalties for these offences may include fines, suspensions, or cancellations of licenses or permits, and in some cases imprisonment depends on the severity of the violation.

26.6 Employees State Insurance Act 1948

- ❖ The Employees' State Insurance Act (ESI) in India is a social security and health insurance scheme aimed at providing financial medical benefits to employees and their dependents.
- ❖ The ESI Act aims to safeguard employees against financial and health-related risks during the times of sickness, disablement, maternity or death due to employment related injuries.

Key points are

1. **Health Insurance:** It provides health insurance and medical benefits to

employees and their families, covering medical expenses, sickness, maternity, disablement and related benefits.

2. **Financed by contributions:** Both the employer and employee contribute a certain percentage of the employee's salary to the ESI fund which is then used to provide benefits.
3. **Coverage:** The Act applies to specified establishments, with a certain number of employees, (usually 10 or more) and covers various industries and sectors.
4. **Medical services:** It includes provisions for medical facilities, and services including dispensaries, hospitals, and clinics managed by ESIC (Employees State Insurance Corporation).
5. **Maternity benefits:** The Act provides maternity benefits, including paid leave for pregnant employees and financial aid during maternity leave.
6. **Extended benefits:** Apart from the medical benefits, the ESI Act also provides for sickness benefits (cash compensation during the period of incapacity), disablement benefits (compensation for work related disabilities) and dependent's benefits (financial support to dependents in case of employee's death).
7. **Coverage of disabilities:** It covers both temporary and permanent disabilities caused by employment-related injuries, providing compensation based on the severity and duration of the disability.
8. **Funeral expenses:** In the unfortunate event of an employee's demise, due to employment related injuries, the Act covers funeral expenses for the deceased employee.
9. **Inspection and compliance:** The Act mandates regular inspections to ensure

compliance with its provisions, ensuring that employers contribute to the fund, and provide the necessary benefits to their employee.

10. **Administrative structure:** The Act establishes the Employee State Insurance Corporation (ESIC) to oversee the implementation and management of the scheme including the collection of contributions and disbursement of benefits.

This Act alleviates the financial burdens on employees during times of distress due to sickness, injury, maternity or death promoting their overall welfare and their families.

26.7 Rights of Person with Disability Act 2016

- ❖ **Right of Person with Disability (RPwD)** Act-2016 is enacted in India to secure and enhance the rights and entitlements of persons with disabilities.
- ❖ This Act covers various disabilities includes various physical, mental, intellectual and multiple disabilities.

1. Physical Disability

❖ **Locomotor Disability**

- Leprosy cured person
- Cerebral palsy
- Dwarfism
- Muscular dystrophy
- Acid attack victims

❖ **Visual impairment**

- Blindness
- Low vision

❖ **Hearing impairment**

- Deaf
- Hard of hearing

❖ **Speech and language disability**

2. Intellectual disability

Specific learning disabilities

Autism spectrum disabilities

3. Mental behaviour (mental illness)

4. Disability caused due to

❖ **Chronic neurological conditions Like**

- Multiple sclerosis
- Parkinson's diseases

❖ **Blood disorders**

- Haemophilia
- Thalassemia
- Sickle cell anemia

❖ **Multiple disabilities**

Rights and entitlements

- ❖ **Non-discrimination:** It ensures equal rights and prohibits discrimination against persons with disabilities in various aspects including employment, education and access to services.
- ❖ **Accessibility:** It mandates accessibility in public buildings transport, information and communication technologies.
- ❖ **Employment:** It provides reservations in govt. jobs and incentives to the private sector, for employing persons with disabilities.
- ❖ **Education:** It ensures inclusive education and provisions for special educators and support staff.
- ❖ **Social security:** Includes provisions for pensions, unemployment allowances and other social security measures.
- ❖ **Healthcare:** It ensures access to healthcare facilities and services tailored to the needs of persons with disabilities.

Responsibilities

❖ **Duty of Government**

- It mandates the government to take measures for the empowerment,

rehabilitation and promotion of rights of persons with disabilities.

❖ **Duty of Establishment**

- It requires establishments to provide reasonable accommodations and accessibility measures for persons with disabilities.

❖ **National and State Commissions**

- It has provision for establishment of National and State Commissions for persons with Disabilities to safeguard their rights, investigate complaints, and monitor implementation.

❖ **Guardianship**

- It provides mechanisms for limited guardianship for those unable to take care of themselves.

❖ **Penal provisions**

- Offences such as discrimination, non-compliance with accessibility norms and contravention of the Act's provisions lead to punishment.
- This RPwD Act aims to empower and create an inclusive society by providing equal opportunities, access and rights for persons with disabilities across various spheres of life.

Summary

Clinical Establishment Act

- ❖ As per this it is mandatory for each and every clinical establishment including every individual clinic, consulting chamber, laboratory or any other investigative or treatment place without indoor beds nursing homes hospital etc by whatever name it may be called to register and follow minimum standards of infrastructure i.e of space, equipment and qualified paramedical staff.

State Ayush Registration Board Rules and Regulation

- ❖ Ayush Registration Board oversees the registration and regulation of practitioners in the traditional systems of Medicine like Ayurveda, Yoga, Naturopathy, Unani, Siddha and Homeopathy in India.
- ❖ Provide registration certificate in order to legally practice medicine to candidates who have obtained graduate degrees from recognized Ayush medical colleges.
- ❖ The board are also tasked to detect and take legal action against quacks and fake certificate holders.

- ❖ Each state typically has its own AYUSH Registration Board responsible for this purpose.
- ❖ They often establish guidelines for education, practice and ethical conduct within the field.
- ❖ These Boards also manage licensing, certifications and ensures adherence to safety and quality standards in Healthcare services provided by practitioners of Ayurveda, Yoga, Naturopathy, Unani, Siddha and Homeopathy in India.

Medicare Service Persons and Medicare Service Institutions Act (Prevention of Violence and Damage or loss to Property) Act

- ❖ This act enacted to prevent acts of violence causing injury, or danger, to the life of persons engaged in Medicare services as also damage to property belonging to Medicare institutions, are on the increase in the country. As a result of such incidents against Medicare persons, patients visiting hospitals have to suffer tremendously.

- ❖ This act is enacted to protect the Medicare service persons and institutions from violence and damage to property and impose punishment on the offender and for matter connected there with and incidental thereto.
- ❖ As per this act, 'Medicare Service Institution' mean all institutions providing medical care to people, which are under the control of State or Central or Local bodies including Govt. and private hospitals.

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The Occupational Safety, Health and Working Conditions Code

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Employees State Insurance Act – 1948

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- ❖ The ESI act aims to safeguard employees against financial and health-related risks during the times of sickness, disablement, maternity or death due to employment related injuries.

Rights of Person with Disability Act 2016

- ❖ Right of Person with Disability Act 2016 (RPwD) is enacted in India to secure and enhance the rights and entitlements of persons with disabilities.
- ❖ This Act covers various disabilities includes various physical, mental, intellectual and multiple disabilities.

Important Questions MCQ

1. Clinical Establishment Act was enacted in the year
a. 2010
b. 2020
c. 1986
d. 1948
2. As per prevention of violence and damage or loss to property, "Medicare persons" include
a. RMP

- b. Registered Nurses
- c. Paramedical staffs
- d. All

3. Schedule E of Drugs and Cosmetics Rules 1945

- a. Poisons
- b. Vaccines and sera
- c. Antihistamines and antibiotics
- d. Prescribed drugs

4. Vaccines and sera are coming under the schedule

- a. H
- b. C
- c. J
- d. F

5. ESI Act has passed in the year

- a. 1945
- b. 1948
- c. 1954
- d. 2000

Answer key

- | | | | | |
|------|------|------|------|------|
| 1. a | 2. d | 3. a | 4. d | 5. b |
|------|------|------|------|------|

Learning Objectives

- Describe the rules and regulation of NCISM.
- Describe the Clinical Establishment Act.
- Describe Medicare Service Persons, Medicare Service Institutions (Prevention of Violence and Damage or loss to Property) Act 2008.
- Describe the Drugs and cosmetic Act- schedules related to poison.
- What are the rules and regulations of Ayush state Registration Boards of concern state?

Important SAQ

- Explain Drugs and Cosmetic Act 1940 and schedules included in the drugs and cosmetic rules.
- Explain Clinical Establishment Act.
- Describe briefly about Employee's State Insurance Act.
- Describe Occupational Safety and Related Laws.
- Describe State Ayush Registration Board and its rules and regulations.

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IMPORTANT IPC, CrPC, IEA SECTIONS

S. IPC 44 defines injury: "Any harm whatever illegally caused to a person body mind, reputation and property."

S. IPC 51: Defines **oath**.

S. IPC 82: Nothing is an offence which is done by a person **under 7 years** of age.

S. IPC 83: Act of a child more than **7 years** and less than **12 years** is an offence, if the child is sufficiently mature to understand the nature and consequences of the act.

S. IPC 84: Nothing is an offence, which is done by a person who at the time of doing it by the reason of **unsoundness mind**, is incapable of understanding the nature of the act, what he is doing is right or wrong or contrary to law.

S. IPC 87: Act not intended or not known to be likely to cause death, or grievous hurt, done with consent of a person **above 18 years**, of age with a sound mind is not an offence.

S. IPC 88: Act not intended to cause death, done with consent in good faith, for person's benefits is not an offence.

S. IPC 89: Act done in good faith for benefit of a child or an insane person by consent of the guardian is not an offence.

S. IPC 92: Act done in good faith for the benefit of the person without his consent is not an offence.

S. IPC 93: Communication made in good faith for the benefit of the person is not an offence.

S. IPC 191: Definition of **perjury**; wilful utterance of falsehood.

S. IPC 193: Punishment for perjury on for giving false evidence is imprisonment for either description of up to 7 years and fine.

S. IPC 197: It provides punishment for issuing false certificates with imprisonment of either description of 7 years.

S. IPC 201: It provides punishment for causing disappearance of evidence of offence, or giving false evidence to protect the offender.

S. IPC 202: It provides punishment for intentional omission to give information of offence by a person bound to inform.

S. IPC 299: It defines culpable homicide. "Whoever causes death by doing an Act with the intention of causing death, or with the intention of causing such bodily injury as is likely to cause death or with the knowledge that he is likely by such Act to cause death, commits the offence of culpable homicide".

S. IPC 300: It defines culpable homicide amounting to murder. Murder is the aggravated form of culpable homicide.

S. IPC 302: It provides punishment for **murder**, "Whoever commits murder shall be punished with death, or imprisonment for life, and shall be also be liable for fine".

S. IPC 304: It provides punishment for culpable homicide not amounting to murder with imprisonment. "Whoever causes the death of any person by doing any rash or negligent Act not amounting to culpable homicide".

S. IPC 304A: It provides punishment for causing death by rash and negligent Act

amounting to culpable homicide with imprisonment up to 2 years and fine.

S. IPC 304B: It defines dowry death, where the death of a woman is caused by any burns or bodily injury other than normal circumstances within 7 years of marriage, and it is shown that soon before the death, the person was subjected to harassment and cruelty by her husband or his relatives – punishment is 7 years to maximum of life imprisonment.

S. IPC 305: It provides punishment for abetment of suicide of a child or insane person with death sentence/imprisonment up to life to 10 years and fine.

S. IPC 306: It provides punishment for abetment of suicide with imprisonment of either description of a term of 10 years and fine.

S. IPC 307: It provides punishment for attempt to murder with imprisonment up to 10 years and fine.

S. IPC 309: It provides punishment for attempt to commit suicide with simple imprisonment up to 1 year or fine or both.

This section is now decriminalised.

S. IPC 312: It provides punishment for voluntarily causing miscarriage with the consent of the woman, with imprisonment up to 3/7 years or fine or both.

S. IPC 313: It provides punishment for voluntarily causing miscarriage, without the consent of the woman with imprisonment up to 10 years and fine.

S. IPC 314: It provides punishment for causing death of a woman by an intended to cause miscarriage with imprisonment up to 10 years and fine.

S. IPC 315: It provides punishment for an intending to prevent live birth of child or to cause his death after birth with imprisonment up to 10 years/fine or both

S. IPC 316: It provides punishment for causing death of an unborn quick child by

an Act amounting to culpable homicide with imprisonment up to 10 years and fine.

S. IPC 317: It provides punishment for exposure and abandonment of child under 12 years of age with imprisonment of either description up to 7 years/fine or both.

S. IPC 318: It provides punishment for concealment of birth by secret disposal of dead body with imprisonment of either description up to 2 years/fine or both.

S. IPC 319: It defines hurt; whoever causes bodily pain, disease or infirmity, to any person is called to have caused hurt.

S. IPC 320: It defines grievous hurt.

S. IPC 323: It provides punishment for voluntarily causing hurt with imprisonment up to 1 year, Rs.1000 fine or both.

S. IPC 324: It provides punishment for voluntarily causing hurt by dangerous weapons, with imprisonment up to 3 years or fine or both.

S. IPC 325: It provides punishment for voluntarily causing grievous hurt with imprisonment of either description up to 7 years and fine.

S. IPC 326: It provides punishment for voluntarily causing grievous hurt by dangerous weapon with imprisonment of either description up to 10 years and fine.

S. IPC 351: It defines assault and battery.

S. IPC 354: It provides punishment for indecent assault with imprisonment of either description of term of 2 years or fine or both.

S. IPC 360: It death with kidnapping from India.

S. IPC 361: It is ascent kidnapping from lawful guardian ship.

S. IPC S. 362: If derives abduction; "Whoever by force compels, or by any deceitful means induces any person to go from any place, is said to abduct that person".

S. IPC 363: It provides punishment for kidnapping with imprisonment of either description up to 7 years and fine.

S. IPC 375: It defines rape.

S. IPC 376: It "provides punishment for rape with rigorous imprisonment of 10 years and which may extend to imprisonment for life".

S. IPC 376A: It says whoever commits rape on a woman and causing permanent vegetative state shall be punished with 20 years to life time imprisonment and may extend to death sentence.

S. IPC 376AB: It provides for punishment for committing rape on a woman less than 12 years, shall be punished with 20 years to life time imprisonment and fine which may extend to death.

S. IPC 376B: A husband doing sexual intercourse with his wife during judicial separation shall be punished with 2-7 years and fine

S. IPC 376C: A public servant or a person in authority or superintendent of jail, remand homes, or women's & children institution, hospital staff doing sexual intercourse with any woman either, in his custody or under his charge shall be punished with punishment of 5-10 years.

S. IPC 376D: "When more than one person acting in furtherance in common intention, rape a woman, each one shall be believed to commit rape will get punishment 20 years to life imprisonment or may death sentence".

S. IPC S.376DA: For gang rape of a woman less than 16 years of age; punishment is **life imprisonment and fine**.

IPC S.376DB: For gang rape of a woman less than 12 years of age punishment is **life imprisonment or death + fine**.

S. IPC 376E: repeated offenders will set life time imprisonment or death sentence.

S. IPC 377: Punishment for unnatural non-consensual sexual activity with **animal** and **children** below the age of 18 is imprisonment of 10 years to life imprisonment with fine.

S. IPC 498: Domestic violence act- "Whoever being the husband or the relative of the husband of a woman, subjects such woman to cruelty, shall be punished with imprisonment for a term which may extend to 3 years.

S. IPC 509: Abusing a woman with sexually coloured remarks- "Whoever intending to insult, the modesty of a woman by utters any word, makes any **sound**, or **gesture** or **exhibits** any object intending that such word or sound shall be heard, or that such gesture or object shall be seen by such woman, shall be punished with simple imprisonment for a term of 1- 3 years with or without fine.

Criminal Procedure Code (CrPC)

S. CrPC 53 (1): An accused can be examined by a doctor at the request of the police even without his consent.

S. CrPC 53 (2): Whenever a female is to be examined the examination shall be made only by/under the supervision of female registered medical practitioner.

S. CrPC 54: An arrested person may be examined by a doctor at his request to detect evidence in his favour.

S. CrPC 174: Police inquest.

S. CrPC 176: Magistrate inquest, exhumation.

Indian Evidence Act (IEA)

S. IEA 107: When the question is whether a man is alive or dead and it is shown that he is alive within 30 years, the burden of proving that he is dead is on the person who affirms it.

S. IEA 108: It provides that when the question is whether a man is alive/dead and is proved that he has not been heard of for last 7 years by those who would have naturally heard him if he had been alive, the burden of proving that he is alive is shifted to the person who affirms it.

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17. The Essentials of Forensic Medicine and Toxicology Dr. K.S. Narayana Reddy.
18. The Essentials of Forensic Medicine and Toxicology Dr. S. Chand.
19. Forensic Medicine and Toxicology Dr. P.C. Ignatius.



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Dr. Jyothi Sajayan is a renowned expert in Ayurveda, with numerous academic contributions and professional achievements. She has authored several articles in esteemed journals and has been a speaker, facilitator, and coordinator at various Ayurveda seminars and programs. Her book, "A Handbook of Agadatantra - Ayurveda Toxicology," was published in 2023.

Dr. Jyothi Sajayan has received the Social Media Impact Award (2023) and the 50 Under 50 Special Women Edition Award (2024). She utilizes social media platforms to promote Ayurveda and health awareness through her Facebook and Instagram pages.

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About the Book :

Illustrated Textbook of Agadatantra evam Vidhi Vaidhyaka, comprising 26 chapters as per the new NCISM syllabus for second professional Ayurveda undergraduate students. Delve into the ancient science of poisons and their antidotes, enriched with modern toxicological insights. It also focuses on a detailed study of visha, upavisha, stepwise guidelines for diagnosis and management of various poisons, with contemporary relevance, therapeutic formulations, and research updates. Descriptions regarding Environmental and Occupational Toxicology explain how Agadatantra can be applied to manage and prevent poisoning in today's industrialized world, addressing the challenges posed by modern environmental and occupational hazards. Forensic Medicine and Medical Jurisprudence offer insights into the role of Agadatantra in modern Forensic Toxicology, including the identification, diagnosis, and management of toxic substances in medico-legal contexts, with a focus on ethical and legal considerations. It is ideal for Ayurveda students, academicians, and a valuable resource for anyone interested in traditional Ayurvedic visha chikitsa knowledge with modern scientific information. This book is written to serve as both an academic resource and practical guide, making exams easier for BAMS and postgraduate students of Agadatantra."

Other useful books for BAMS 2nd Professional

1. ŚĀRŅGADHARA SAMHITĀ by ŚĀRŅGADHARA : Text with Transcendence descriptive English commentary by Prof. Ravindra Angadi
2. ŚĀRŅGADHARA SAMHITĀ by ŚĀRŅGADHARA : Text with English commentary by Prof. R. Vidyanath
3. BHAIŠAJYA RATNĀVALĪ by GOVIND DAS SEN : Text with Transcendence descriptive English commentary by Prof. Ravindra Angadi (in two parts)
4. A TEXT BOOK OF BHAIŠAJYA KALPĀNĀ (as per NCISM UG & PG Syllabus) by Prof. Ravindra Angadi
5. A TEXT BOOK OF RASĀŚĀSTRA (as per NCISM UG & PG Syllabus) by Prof. Ravindra Angadi
6. VAIDYAKA PARIBHĀṢĀ PRADĪPA (The captivating magic of classical Ayurvedic terminologies) by Prof. Ravindra Angadi
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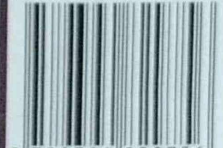
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